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ENGINEERING AND MINING JOURNAL

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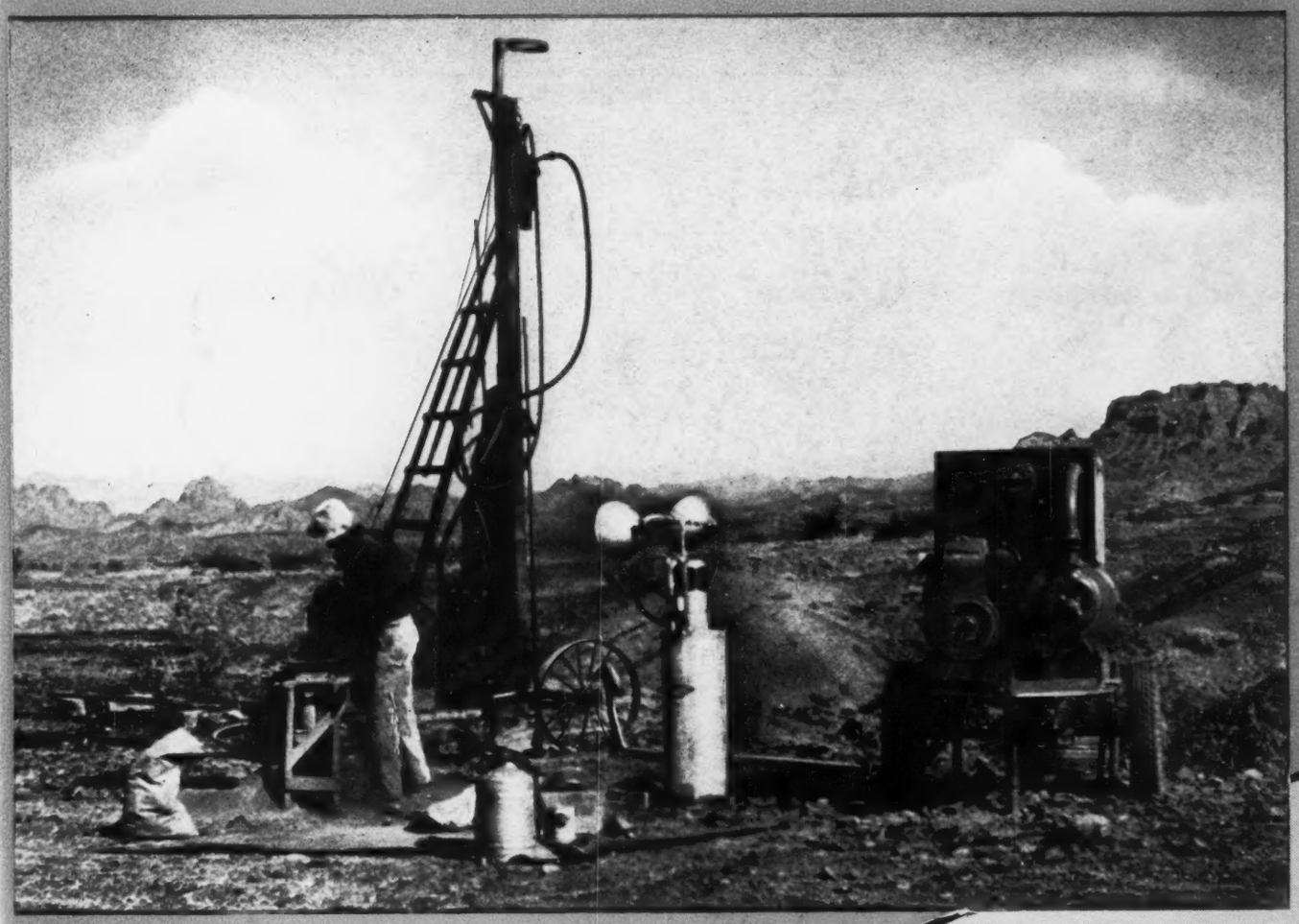


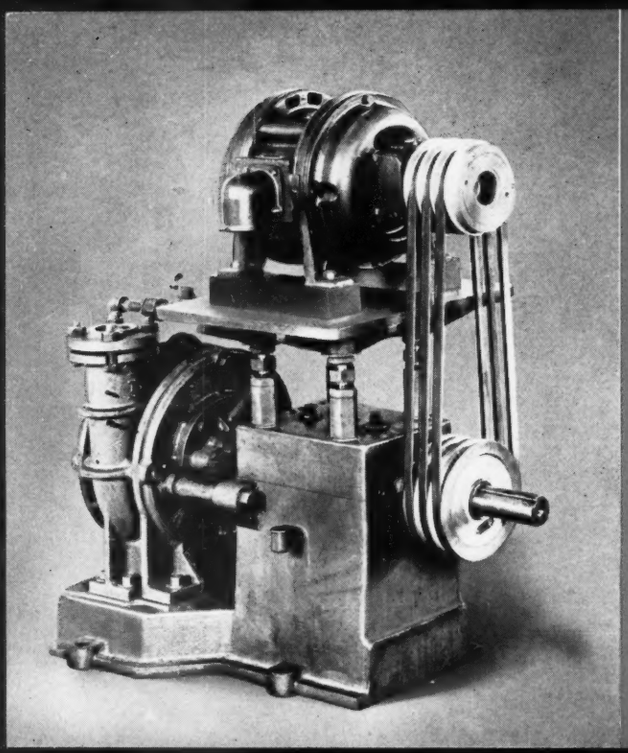
On the Picacho property, near Yuma, Arizona. A sample taken with the wagon drill and vacuum collector is being cut down on a Jones riffle.

In this issue

SOMETHING NEW—SAMPLING THE PICACHO

Truck Transport in Open Pits . . . Moving Ore and Tailings on Tri-State Highways . . . *and in comparison*—The Jerk Line, by C. J. Hutchinson—a story of transport in a bygone day

Table of Contents on page 23



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Next month: *E.&M.J.'s* Annual Review, appearing at mid-February. The contents, as planned, will look forward as well as backward, comprising articles on the position of the major non-ferrous metals in 1939, the course of events in mining areas at home and abroad, and the trends in technology. In addition, the February Number will include, as a supplement, a copy of the new 28x40-in. wall chart of *E.&M.J.* Metal Prices and Production Statistics.

▼

Gold dredging in Montana boasts conveniences that ease the rigors of weather for the dredgemaster. Porter Brothers, on Last Chance Gulch, below Helena, heat their boat with natural gas from the Power Company's mains near by, bringing the fuel aboard through rubber tubing. Star Pointer Exploration, northwest of Philipsburg, expects to keep running steadily by diverting into its pond water from an adjacent hot spring. In fact, recent years have seen little winter trouble for Montana dredges.

▼

Copper, as such, is the subject of countless squibs broadcast by Copper and Brass Research Association: Miles and pounds of it in the "Yankee Clipper," hundreds of tons in the new flagship "America," ancient instruments from Egypt's tombs, vast networks under New York's streets, statues of the metal here and there, strands of it finer than human hair, and Drakes's plate, with which Sir Francis essayed to take over California and its climates for good Queen Bess, calling the land "New Albion," no less.

▼

Tin has one curious characteristic, said Marshall Tuthill, in a talk at Columbia's recent anniversary sessions on strategic minerals. It is subject to the "tin pest," resembling a disease. Left standing long in extreme cold, it has been known to disintegrate slowly into a powder, which can—and must —be re-refined. If the United States accumulates a military stockpile of tin, the metal should be kept safely above the freezing point, said Mr. Tuthill.

Government crushing and cyanide plants may be considered a feature of Australian mining. The Department of Mines of South Australia, at Adelaide, reports that the five plants within its bailiwick have treated a total of approximately 68,538 tons of ore since starting this in small lots.

H. C. PARMELEE
Editorial Director

ENGINEERING AND MINING JOURNAL

H. W. CLARKE
Vice-President

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Contents for JANUARY 1940

Vol. 141, No. 1

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Editorials	27
Sampling the Picacho With Drill and Vacuum Collector — Leon W. Dupuy	29
Three Years of Operation With a Hadsel Mill — George A. Bell	32
Truck Transportation in the Tri-State District — W. F. Netzeband	34
The Jerk Line — C. J. Hutchinson	35
Open-Pit Transportation on the Mesabi Range—VII — L. C. Moore	39
Ore Theft—II — T. A. Rickard	44
Curious Gold	47
Impurities in Minerals of Picher District	47
The Colored Slates of Vermont and New York—II — David M. Larrabee	48
Placering Has Its Pitfalls! — Merle H. Guise	53
Useful Operating Ideas	54
Book Reviews, Publications Received	56
Summary of the Markets	58
Personal Items, Obituaries	61
News of the Industry	63
Equipment News	87

COVER ILLUSTRATION: On the Picacho property, near Yuma, Arizona. A sample taken with the wagon drill and vacuum collector is being cut down on a Jones riffle. (Cover space released for editorial use by Electric Storage Battery Company)

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America's progress on land and sea and in the air flows from our underground resources

THE INDUSTRIAL PROGRESS that has placed the United States at the forefront of all nations is based on the abundance and constructive use of our varied natural resources. To the extent that ours is a "machine age," that our industry, our land, water and air transportation, our communication systems and mode of living depend on power and minerals—to this all-embracing extent America's progress has its roots in the coal and ore mines that supply the essential substance of our age.

It is natural that technical progress should become a basic part of the mining industry that furnishes the raw materials on which such progress is built. Storage battery locomotives, loading machines, and shuttle cars are three notable examples of advances in coal mining technique alone.

In all of these the Exide-Ironclad Battery has played a leading part. As power for locomotives, trammers and shuttle cars, it has brought new speed, higher capacity, and greater flexibility to underground haulage, not only in coal and ore mines, but in quarrying, tunneling and construction operations throughout the nation. These key industries and Exide-Ironclad Batteries are literally *partners in progress.*

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Volume 141 Number 1

JANUARY 1940

Pattern for 1940

THE PATTERN for general business activity in the United States for 1939 paralleled that for 1938, except that 1939 was on a substantially higher level, say 20 per cent higher. In each year there was mild recession toward summer, followed by a gradual rise to the year-end, ultimately reaching levels above those at the beginning. In this respect both 1939 and 1938 differed from 1937, which showed a gradual rise from January to mid-summer and then a disastrous slump to a year-end level about 30 per cent below that of January.

What of the pattern for 1940? Realistic examination of conditions suggests that it may follow those of 1939 and 1938, with business activity tapering off during the first half of the year and rising again in the fall. Readjustment has already begun in some quarters. Steel ingot production has receded for several weeks in succession, and the Federal Reserve index is beginning to decline. Private investment continues to lag. Factors favorable to a good pattern for 1940 are in marked contrast to those prevailing at the opening of 1937. New and unfilled orders of manufacturers continue higher than they were a year ago. Warnings against excessive inventories and price rises have been heeded, so that business enters this year more soberly, if less buoyantly and enthusiastically, than it entered 1937. Definite prediction for 1940 is unusually perilous, but the pattern as far as one can see it looks favorable, with war and politics the uncertain factors.

Moral Embargoes

LATE IN 1939 the Administration inaugurated a policy that has resulted in a series of "moral embargoes" on American exports of essential war supplies to those nations that engage in aërial bombardment of civilian populations. This was a gesture of protest against atrocities that shocked the sensibilities of civilized people. No nations were mentioned by name, but everyone who had followed the course of recent "undeclared" wars knew against whom the embargoes were directed—Japan and Russia.

Obviously, aircraft manufacturers were the first to feel the effects of the embargo, their products being the immediate weapons of offense. But the Administration was not long in noting the strategic character of molybdenum and aluminum, and these were added to the list. Then an embargo was laid on plans, equipment, and technical information pertaining to the manufacture of high-test aviation gasoline. Finally, although copper is not likely to be included immediately, it is known that the State Department has considered that possibility.

The United States is the principal producer of molybdenum, accounting for over 90 per cent of the world's output. Exports are known to be a substantial portion of domestic production. So an embargo, moral or otherwise, becomes a serious business handicap. Of the world's aluminum this country produces roundly one-fourth, being exceeded only by Germany. Exports have not loomed large, but a substantial tonnage has been sold abroad. Japan and Russia have recently been heavy buyers of both these metals, as well as of copper.

It is pretty clear, therefore, that these embargoes by a peaceful nation add to the disruption of industry and trade already upset by countries at war. And they fall with a heavy hand on mineral products that enter into world trade; much heavier than on aircraft, for example, which are being produced at full plant capacity and for which there remains a large domestic and foreign market even if business with Japan and Russia is declined. So the mineral industry bears the brunt of these economic sanctions. Are they "neutral"? Will they have the desired "moral" effect on Japan and Russia, or will they only arouse animosity and antagonism that will have still further

repercussions? The ramifications are endless. We hope the Administration has balanced all the factors against the obvious humanitarian motive with which all are sympathetic.

Excellence in Mining Education

IN ITS ANNUAL REPORT last October to the Engineers Council for Professional Development, the Committee on Engineering Schools reviewed the work of the past five years in inspecting engineering schools and accrediting engineering curricula. One hundred and forty degree-granting engineering schools were inspected by visiting committee. Of that number only 22, or 16 per cent, had no curricula accredited. The total number of curricula considered was 687, of which 172, or 25 per cent, were not accredited, even provisionally.

Schools of mines and metallurgy fared better than the average. Of 32 curricula in mining engineering and 31 in metallurgical engineering only 3 of each failed to be accredited, and only 2 and 4, respectively, were accredited provisionally. Thus less than 10 per cent of these curricula failed to find approval, compared with 25 per cent for all. On the other hand, curricula labeled geological engineering fell by the wayside. Of 7 submitted for consideration, 5, or about 70 per cent, were not accredited. Without presuming to know why, we surmise that they lacked adequate engineering content and were merely highly specialized courses in geology. The Committee distinguished clearly between the label of a curriculum and its engineering content, and declined to accredit many highly specialized courses. On the whole, however, the inspection of schools of mining and metallurgy revealed a high degree of excellence.

Retreat From Chile

FOR THE FIRST TIME since it began to negotiate reciprocal trade treaties under the Trade Agreements Act, the State Department has heeded a protest and receded from its position. Copper will *not* be one of the items affected when the trade treaty with Chile is finally negotiated. It was the expectation that the Department would consider reduction of the import tax on copper from 4¢. to 2¢. per pound. But the storm of disapproval registered at the hearing in November was sufficient to cause a retreat on December 21 before the treaty was concluded.

Various interpretations will be put on the State Department's unprecedented action. Some will regard it as a victory for the contention that only those commodities subject to tariff duties are open to negotiation, and that those protected by excise taxes cannot be considered. Others will feel that the State Department became convinced, before it was too late, of the widespread economic dislocation that would be produced in the copper industry at home and abroad if the domestic excise tax were reduced. But the more likely explanation is that Washington's weather eye took note of the gathering storm of protest against the whole reciprocal trade treaty program, and staged a retreat as a gesture of conciliation to the current session of Congress. Probably it was deemed better strategy to lose a preliminary skirmish than to jeopardize the success of a whole campaign.

Alsifilm

RECENT RESEARCH on colloidal clays like bentonite has resulted in the development of a new material to which the name Alsifilm has been given, derived from *al*uminum *si*licate *film*. It is a coherent, self-supporting film of pure colloidal clay exhibiting some commercially interesting properties. Development is still in the laboratory stage, and commercial production is not likely to occur for a year or so. In the meantime the properties and possible uses of the new material are being studied. Thus far its physical and dielectric properties indicate its possible substitution for mica splittings in making laminated mica plate, but there is no evidence that it will displace mica in its large industrial uses.

HISTORICAL SUMMARY: ENGINEERING AND MINING JOURNAL was founded in 1866 as the *American Journal of Mining*, the title being changed in 1869. Publications with which *Engineering and Mining Journal* has been consolidated comprise: *Coal and Iron Record* (1875); *The Mining Review* (1877); *The Polytechnic Review* (1870); *Mining and Metallurgy* (1902); *The Mining Magazine* (1906); *Mining and Engineering World* (1917); *Mining and Scientific Press* (1922); *Engineering and Mining World* (1932). All rights to the foregoing titles of consolidated publications are reserved by the publisher. . . . . THE FOLLOWING have served as editors-in-chief of *Engineering and Mining Journal* and its predecessor publications: G. F. Dawson (1866–67); R. W. Raymond (1867–74); R. W. Raymond and R. P. Rothwell (1874–89); R. P. Rothwell (1890–1901); D. T. Day (1901–02); T. A. Rickard (1903–05); W. R. Ingalls (1905–19); J. E. Spurr (1919–27); A. W. Allen (1927–33); H. C. Parmelee (1933—) . . . . THE EDITORIAL STAFF of *Engineering and Mining Journal* comprises: H. C. Parmelee, editor; A. H. Hubbell, associate editor; H. C. Chellson, W. N. P. Reed, J. B. Huttl, assistant editors; H. H. Wanders, market editor; G. J. Young, consulting editor.

Some of the ground sampled on the Picacho property is rough, making it difficult to move the equipment about

Sampling the Picacho With Drill and Vacuum Collector

Novel method using equipment designed for dust removal is employed on 27,845 feet of hole, in five months of 1939, at a direct operating cost of 39 cents per foot

Leon W. Dupuy
Engineer in Charge
Picacho Mining Company
Yuma, Ariz.

EIGHTEEN MILES north of Yuma, Ariz., on the California side of the Colorado River, lies the Picacho gold mine, situated in a basin which is surrounded by precipitous hills on three sides, and the river on the other. This mine was discovered during Civil War days and was intensively worked at the turn of the century. For the past thirty years it has lain idle, but it has now been brought to life by the Picacho Mining Company, a California corporation. The transformation was made possible by the development of a new and interesting drilling and sampling system.

Several methods of sampling were considered for use in the development of the property, including churn drilling and diamond drilling. It was found, in trying them, that in each case these common methods did not give satisfactory results, principally because the water used in drilling permitted concentration of gold in the bottom of the hole and consequent "slugging of values." To overcome this difficulty it was decided to drill dry with a heavy pneumatic rock drill and to catch the cuttings in some manner by blowing.

As the first step, a No. WD 33 Worthington Tower wagon drill and a 315-cu.ft. diesel-powered air compressor were secured. These were used in conjunction with an engine-driven vacuum sample collector, of Kadco make, equipped with shaker gates and suitable collector cans. The collector was connected to the drill holes through suction hose attached to a closure hood at the mouth of the drill hole.

Tests with this equipment were entirely satisfactory. Test pits sunk on drill holes, when sampled by channel sampling, checked well within the limits of normal sampling errors. The preliminary testing was done in 1937. In the summer of 1938 a definite drilling and sampling program was arranged.

Drill holes were spotted at 100-ft. intervals so as to fit on the mine coordinate system (and, as is the usual expectancy, many of the coordinates intersected in places that made difficult set-ups). Two wagon drills were employed, each working two shifts per day. Each drill was equipped with its own compressor, of the type and size previously mentioned, and its own sample collector.

Procedure followed on drilling a hole on the surface was: Using a 10-ft. drill rod (1¼-in. hollow-round drill

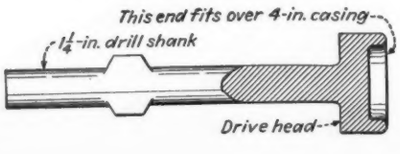
steel) with a 2-ft. starter rod connected by a screw coupling and a 3½-in. detachable bit, a hole was started in the surface gravel. After a few feet had been drilled, a 4-in. casing was inserted in the hole in the gravel and driven into the hole as far as it would go. There was sufficient wobble or play in the string of tools to drill a 4-in. hole in cemented gravel with a 3½-in. bit which permitted driving the casing.

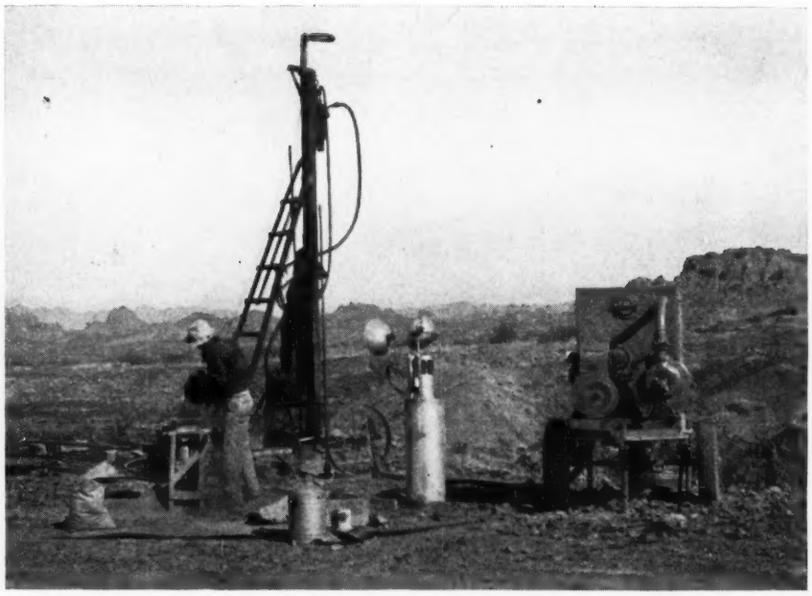
The hole was then blown out with air, using 1-in. garden hose because of its lightness. Cuttings were caught by the vacuum collector. The bit was then inserted in the pipe or casing and drilling was continued below the bottom of the casing. The process was repeated until the casing was set on bedrock.

The greatest depth to which any casing was sunk was 32 ft., this through gravel. After the casing was set on bedrock the bit size was changed to 3-in. gage, and the hole continued in solid rock from then on without casing. It was found of the utmost importance to keep the casing vertical and straight, thus providing a guide for the tools to operate at depth.

To drive the casing a drill shank was fitted with a drive head which in turn fitted over the top of the casing, as shown in Fig. 1. The drill, which has independent motor rotation with separate control, was then used with the *rotation shut off* to drive the pipe (casing) into the hole, the drill acting as a pile driver. Old 4-in. black iron pipe was used as casing—generally in short lengths. If added depth were needed, pipe with threads and connecting collars was used, except when the casing was to be driven over 12 or 15 ft. In this latter case extensions were welded on to the casing being sunk to eliminate the excess friction that would otherwise have been had, if we had used the screwed collars as we did in the shallower work. The time consumed to drive casing three or four feet averaged about 20 minutes; but if casing were required for 30 ft. it generally took a shift to get it set in place. No casing was used after passing alluvium. Most holes required not over 5 ft. of it. Samples were taken at 5-ft. intervals and were secured by keeping a vacuum on the collar of the hole to catch all dust or cuttings that were carried to the collar by the air sent down through the needle and the hollow drill rods to the bit. This air, with the assistance of the vacuum at the collar, kept the remaining cuttings in suspension above the bit and prevented them from packing and thus causing the tools to stick.

Fig. 1. . . . Casing 4 in. in diameter was driven with the aid of a drill shank fitted with a drive head, as shown





Sample drilling on the Picacho property. The wagon drill and the dust-collecting equipment employed for catching the cuttings blown out of the hole are seen. A sample is being cut down on the Jones riffle. Night work is permitted by the lamps

After 5 ft. of hole had been drilled, the tools were withdrawn and a 1-in. hose was lowered to the bottom. This hose had a larger inside diameter than that of the drill rod and so permitted more air to reach the bottom to carry out the remaining cuttings. The air was carefully controlled during this blowing operation, so that the flow would be in proportion to the ability of the vacuum collector to take away the air and cuttings. When the bottom had been blown clear, the air was left on as the hose was withdrawn, this in order to provide a cushion and prevent any particles still on their way up from being sucked back or falling back into the hole. By using proper care in blowing, all the cuttings were recovered and a perfect sample was secured by emptying and cleaning the vacuum collector.

It was found advisable to keep the bit size rather large, especially on the deep holes, because of the likelihood of having fishing jobs, which was possible at any time due to the breakage of rod or coupling. The holes were bottomed at no less than 2½ in., the bit size being decreased ⅛ in. on each change. A hole of this diameter permits a ⅜-in. pipe to be lowered into it alongside of the stuck or broken rods, thus making it possible to blow out gradually whatever cuttings were lodged beside them. The fishing tools were of the common socket type intended for use with the rods and couplings employed.

In the preliminary test work done in 1937 the rock drill was taken underground and mounted on a tripod. Eight holes were drilled there, both horizontal and at 45 deg. slope upward. The deepest underground hole was 166 ft., horizontally. Samples were taken as usual with the vacuum collector. A total of 656 ft. was drilled underground.

The sample interval in the early work was 10 ft. In the 1938-39 program, however, it was reduced to 5 ft. to provide more detailed data. Drilling records for the surface drilling are given in the accompanying table.

The ore drilled is a somewhat crushed and altered oxidized gneiss, with an andesite capping. It lies usually in a somewhat undulating bed, sometimes dipping sharply enough to be veinlike in structure. There are three principal orebodies, so far developed, called the Dulcinea, Apache, and San George. Other orebodies are known but have not yet been sufficiently explored to be considered important. The Apache and San George are situated in rough country, whereas the surface in the neighborhood of the Dulcinea is fairly level.

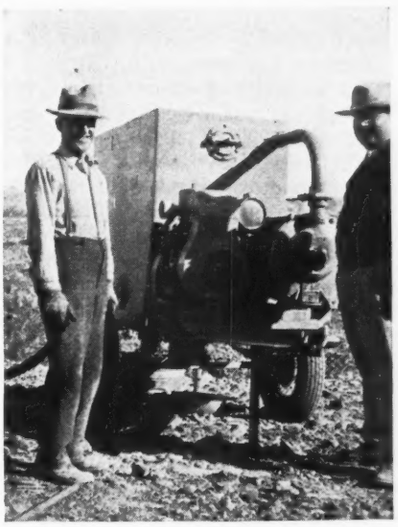
Moving the drill and compressor in the Dulcinea area offered no problem,

Surface Drilling Records at Picacho Gold Mine

Period	No. Holes	Total Footage	Deepest Hole, Ft.	Average Depth, Ft.
1937 test work.....	47	3,154	100	67
1938-1939 program	449	42,382	150	94½

inasmuch as a 1½-ton Ford truck could easily haul them around, but where the Apache and San George were concerned, it was often difficult. We found, however, that the tugger hoist on the drill rig was powerful enough to pull the rig and the vacuum collector up exceptionally steep grades if sufficient strands were reeved on a set of blocks. The accompanying illustrations show some of the country in which the drill was placed.

Breakage of the rods was confined entirely to the ends at points within the threads. It occurred oftenest close to the tip end of the threads, although occasionally it would take place at the rod end of the grooves. Failure near the tip caused the standard collars (sometimes called couplings) to break frequently during the early days of drilling. This was caused primarily by the fact that the couplings which can be purchased for this work are tempered to a point where they are very hard and brittle. To meet this problem, the manufacturer had couplings made from a different alloy and used a special heat-treatment. These were called "soft collars" locally, and their use stopped all breakage of collars and saved much fishing. When the rod would chip or the tip would break off there was generally thread enough left to pull the rods from the holes. Fishing jobs became relatively few.



A nearer view of the vacuum sample collector

Thorough annealing of the rods when they were rethreaded after breaking reduced their breakage materially. The procedure, when one broke, was to anneal and cut off the remaining old thread, rethread, then anneal again and cool the rod in lime, after which it was tempered to a point where a file drawn across the threads would just cut and no more.

Drilling speed was governed largely by the depth of the hole. A crew could set up and drill 80 ft. in one hole in one shift of eight hours, provided the movement from one hole to the next was on reasonably level ground and not too far away. To drill a hole 120 ft. deep required two shifts, and a 150-ft. hole 3 to 3½ shifts. A 50-ft. hole could be finished in three to four hours. No definite time schedule record was kept by hours, as the drillers were always cautioned that they were sampling rather than racing for footage in competition with each other, and that the sampling was all-important. Drilling speed also depends a great deal on the type of ground. The better ore generally was more difficult to drill than that of lower grade, though this was not always so. A 100-ft. hole was completed occasionally in one shift. No trouble was had with sloughing off or caving of walls of the hole once it was properly cased to bedrock.

One feature in the successful operation of this drilling system was that the drill used on the rig is equipped with a positive and independently operated motor rotation rather than the common rifle-bar type. Independent rotation made it possible to drill over 40 or 50 ft. in vertical depth. In difficult ground no trouble was had, so long as the rods could be kept rotating.

Each drill had a crew of three men, consisting of driller, helper, and sampler, on each shift. The driller was in charge. The sampler kept a log book describing the formation penetrated. He also copied this information onto the ticket for each sample. This ticket showed, for example, the depth of the hole at the start and finish of the sample, the character of the material (brown gneiss, red gouge, red andesite, or whatever it happened to be), the date, the number of the hole and its location by coordinates. These data were also copied into the log prepared by the assay office and were subsequently typed onto assay report blanks.

The ground drilled was dry. Presence of water causes gumming up of the cuttings. A small amount of water can be overcome by using sufficient air in blowing, but any material amount of it interferes with the sampling.

The direct operating cost of the drilling was 39c. per foot over a period lasting from Jan. 1, 1939, to and including May 31, 1939, during which time 27,845 ft. of hole was drilled. Holes varied in depth during this period from 50 to 150 ft. This cost included the driller and helper on each shift and one-fourth of a shift per drill-shift for the drill foreman. It also included all supplies and the repairs made on the drilling outfits, the compressors, and the dust collectors. It did not include the wages of the sampler, the cost of assaying, haulage or truck service, equipment rental or amortization, nor any general overhead such as engineering or management. The cost given was thus an actual operating and maintenance cost. It should be said at this time that the cost for repairs was exceptionally low. A rather noticeable example was that one of the drills drilled 12,986 ft. before any repairs were needed, and then it was only a chuck ring bushing that required attention. Lost time for repairs was practically negligible, all equipment giving excellent service.

Sufficient ore was developed by this program of drilling and vacuum-sampling in 1939 to justify the installation of a mill, toward which end effort is now being made.

Due credit should be accorded to Charles A. Hirschberg, of the Worthington organization, in New York, who originated and recommended the method to the Picacho company; also to E. Lansing Jones, director of the mining company, and to J. G. Murphy, district manager for Worthington in Los Angeles, for their perseverance in the working out the vacuum sampling method successfully in the field. Grateful acknowledgment is also made to Hugh Park, general manager of the Picacho company, for permission to compile and publish the data that have been given.

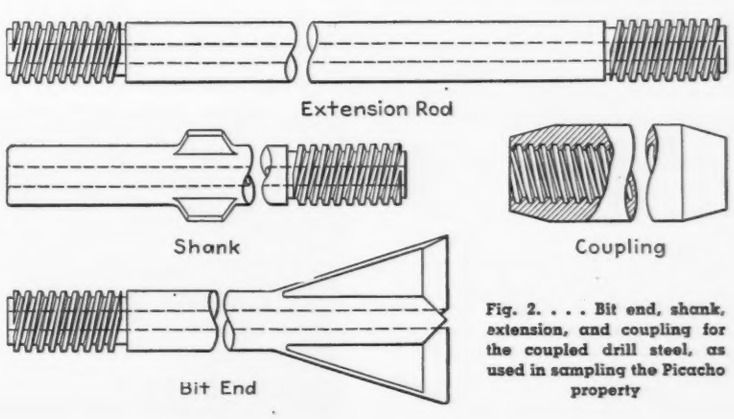


Fig. 2. . . . Bit end, shank, extension, and coupling for the coupled drill steel, as used in sampling the Picacho property

Three Years of Operation With a Hadsel Mill

Demonstration Gold Mines, in the Philippines, finds its 20x4-ft. new-type machine economical in work and maintenance, mechanically sound, and ideal for one-stage crushing of wet, sticky ore

George A. Bell
Mill Superintendent
Demonstration Gold Mines, Ltd.
Baguio, P. I.

THREE YEARS of successful operation can now be credited to the Hadsel mill [1] which was installed as a single-stage crushing unit at the plant of the Demonstration Gold Mines, Ltd., at Baguio, in the Philippines. During this period it has handled approximately 250,000 tons of mine-run ore successfully.

These ores are composed of andesite, quartz, breccia, calcite, and a kaolinized material which forms a sticky gouge that can be put through an ordinary crushing plant only with great difficulty. The andesite rocks and the breccia, moreover, are tough and abrasive. The moisture content of the ores varies from 8 to 20 per cent, according to the rainy season, and the amount of primary slime ranges from 5 to 20 per cent.

Owing to the physical character of the oxidized ores, a washing plant was deemed necessary to remove the sticky clay from the rock before attempting to crush the latter in standard types of crushers. After a consideration of installation costs and of the mill space available, it was decided to install the new type of Hardinge-Hadsel mill as a combined washing and crushing plant.

A general description of the plant flowsheet and the metallurgy involved has already been described in two papers.[2, 3] Fig. 1 is a flowsheet limited to the crushing and fine-grinding units of the 250-ton cyanide section of the mill.

Referring to Fig. 1, run-of-mine ore is delivered to the mill in 20-cu.ft. tram cars. After being weighed and sampled, the cars are dumped into the feed hopper of the Hadsel mill through a 12-in. sledging grizzly. A better method of feeding the mill would be from a surge bin over a pan feeder with a variable-speed drive.

Solution is added to the feed-hopper to maintain a fairly thick pulp in the mill. The pulp passing the take-off grizzly is sluiced to the outside classifier with sufficient solution to control the density of the classifier overflow. This overflow, containing the original slime in the ore and that produced in crushing, flows to a surge tank which delivers to the bowl classifier of the ball mill.

The "sand" from the Hardinge classifier is conveyed directly to the fine-ore bin. Table I gives a screen analysis of the finished products. The tonnage of coarse and fine products varies with the ore, the size of grizzly used, and control of the classifier overflow. The average has been approximately fifty-fifty.

The size of product and the capacity of the Hadsel mill may be varied by changing the ring size of the take-off grizzly. Grizzlies with ¼- to 2-in. openings have been tried. For the present operations a 1-in. grizzly of punched plate is being used.

Fig. 2 is a sketch of the Hardinge-Hadsel mill. This installation is a 20x4-ft. machine of the new type, which is driven at 3.30 r.p.m. by a 75-hp. motor, connected through a V-belt and a gear train. It has a rated capacity of approximately 100 tons of ore per 24 hours at 60 per cent minus-200 mesh.

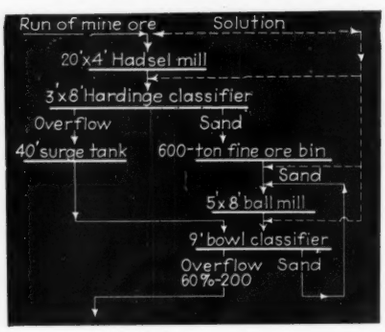
The mill was installed only for crushing and washing operations, leaving the fine grinding to be done in the regular ball-mill circuit. However, during the first two days of operation, while the ore bins and other changes were being completed, it successfully produced 100 tons of 60 per cent minus-200 product daily. It is of rugged construction and, with proper operation and care, should last indefinitely. After three years of operation, it appears as good as new. It was furnished with a 3x8-ft. Hardinge countercurrent classifier which serves to separate the product of the take-off grizzly into a "sand" and slime as already shown.

In operation, a native workman keeps the mill loaded to capacity with the aid of an ammeter on the switchboard. Overloads are prevented by an automatic cutout in the motor circuit. The operator also controls the density of the mill pulp and that of the classifier. The mill starts and stops easily under full load. Overloading and negligence are the only factors affecting efficient operation. Tramp iron, wood, and other refuse from mining operations do no harm and are removed occasionally when ore is not being delivered.

Capacity varies with the hardness of the ore and size of product desired. Under average conditions, the products being as shown in Table I, a capacity of 20 tons per hour is easily obtained.

To reduce the elevating load of finished material circulating within the mill, a splash plate to throw more pulp over the take-off grizzly was installed. Approximately the same result may be obtained by using a peripheral speed that is 10 per cent slower. The net

Fig. 1 . . . Flowsheet of the crushing and fine-grinding section of the 250-ton cyanide unit of the Demonstration mill



[1] A description of the Hadsel mill was published by the *E. & M. J.* in April, 1932. Subsequently, observations by R. G. Hall were published by the A.I.M.E. in a manuscript in 1934.

[2] "Milling Practice at Demonstration Gold Mines, Ltd." T. P. 1017, A.I.M.E., by George A. Bell.

[3] "Operations and Metallurgy at Demonstration Gold Mines, Ltd." By George A. Bell. Mining Year Book, Philippines, 1939.

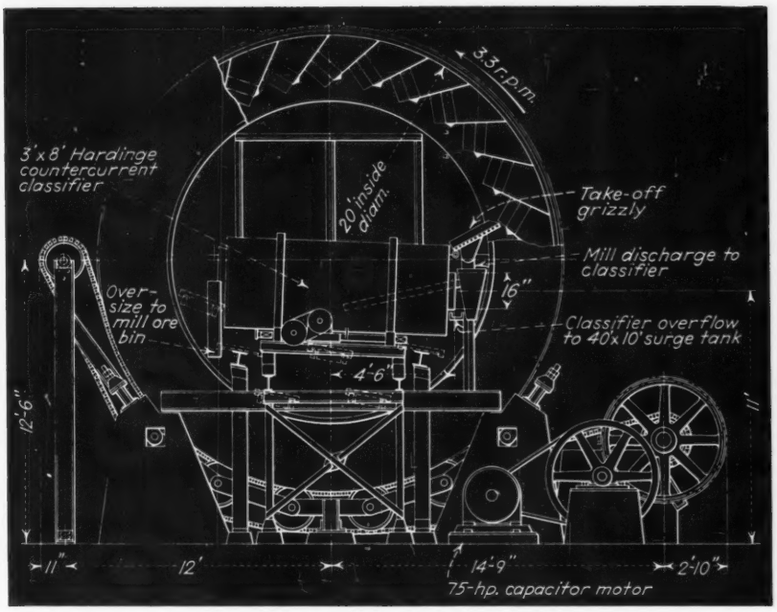


Fig. 2 . . . Sketch showing a side elevation of the 20x4-ft. Hardinge-Hadsel mill in service in the mill of Demonstration Gold Mines

result is a considerable saving in power and an increase in capacity.

Power consumption averages 3 kw.-hr. per ton of ore. This represents power consumed in washing, crushing, and the fine grinding done by the mill, the last averaging 50 tons per day. Credit for this amount of fine grinding more than pays for the cost of actual operation. This credit, although not entered on the cost sheets, is evident from the fact that the daily tonnage increased by over 50 tons upon starting operations with the Hadsel mill. Further, this increase was obtained after one 5x4-ft. ball mill was taken out of the fine-grinding circuit.

As to maintenance, repairs are slight and are easily made by native mechanics. The original installation and all repairs to date have been done without the aid of master mechanics. Changing of breaker plates, bucket plates, or side liners is easier than relining a ball mill or replacing the wearing parts on ordinary crushers. The electric welding of wear plates and other parts has been a great advantage.

Table I—Screen Test on Products of Washing and Crushing Plant

Washed "Sand" (To Ore Bin) Ring Size or Mesh	Per Cent	Slime (To Surge Tank) Mesh	Per Cent
−1 in. + ½ in.	51.7	+10 mesh	23.0
−½ in. + 10 mesh	44.3	−10 + 20 mesh	2.5
−10 mesh + 20 mesh	1.7	−20 + 40	6.5
−20 + 40	0.7	−40 + 60	8.5
−40 + 60	0.6	−60 + 100	11.0
−60	1.0	−100 − 150	7.5
		−200	33.5
Total	100.0	Total	

Substitution of abrasive steel plate for mild steel, and the use of thicker breaker plates and manganese lips on buckets give a continuity of operations comparable to that had in ordinary ball-milling. The list of spare parts is smaller than with standard machines to accomplish the same work.

Manganese-steel breaker plates last approximately four months. Mild steel bucket plates and mill liners last twelve months. Drive chain pins and bushings are changed every twelve months. Rollers, tires and sprockets appear to be good for six to ten years' service. Table II gives the steel consumption. Table III gives operating costs per ton of ore crushed.

Conclusions

After a period of three years' successful operation on 250,000 tons run of mine ore, sufficient data and information have been obtained to warrant certain conclusions.

1. The mill is ideal for crushing wet and sticky ores in one stage.
2. The mill is mechanically sound and will crush to any desired size of ball-mill feed efficiently.
3. Operating cost per unit of actual work done is less than with standard machines.
4. There is a considerable saving in equipment. Breakers or coarse crushers, fine crushers, scrubbers, screens, and elevators are absolutely eliminated. Furthermore, due to the grinding done, a considerable reduction in the fine-grinding equipment necessary is obtained.
5. The savings achieved from operating fewer machines is evident, with the consequent reduction in amount of materials, labor, power, and mill space, as well as in capital outlay.
6. Slight changes in the construction of the mill will improve its efficiency. However, this is true of all milling machinery.

▼ ▼ ▼

A Philippine "Information Circular"

BENEFICIATION of manganese ore occurring on the property of the Grawfus Mining Company at Dirique, Ilocos Norte, in the Philippines, is the subject of a preliminary report (Information Circular No. 2) by W. F. Boericke and N. M. Lim, of the Bureau of Mines at Manila. These engineers state that in the main the ore appears to be residual, surficial deposits, irregularly distributed in patches over a barren bottom of clay, associated with boulders. The estimate of 10,000 to 15,000 tons of recoverable ore made by the management appears to be conservative. The manganese is mainly nodular. All ore is mined by hand in open pit.

Most of the working faces are 4 to 6 ft. high. Boulders are often found. Ore is mined at near-by points and customarily is brought to a 32-ft. log washer in 2½-ton trucks. At the time of the visit, the log was treating 42 tons of crude material, running 29.3 per cent Mn and 5.85 moisture, per 8-hr. shift. This yielded 20.5 tons of oversize (nodules) running 34 per cent Mn, when put over 8-ft. by 32-in., 4-mesh shaking screen, 9.5 tons of −4 mesh undersize running 24.1 per cent Mn and 12 tons of slimes running 25.3 per cent Mn.

The plus 4-mesh oversize of the screen was picked by hand on a belt and the concentrates were stocked. The minus 4-mesh fines were treated on a standard 2-cell Harz jig, the cells being run as units. The 8 hr. output was 1.8 tons of cleaned concentrates.

Recovery by the log was 56.6 per cent, counting the nodular material only. The washing increases the grade of this material by 5 to 6 per cent. It is calculated that 24.7 per cent of the manganese is lost in slimes. As to possible improvements the authors suggest that crushing to finer size, followed by classifying and tabling, will permit a better separation than would the jigging of the coarse sizes. This, however, would raise the question of selling a finely ground product.

Table II—Steel Consumption

	Manganese-Steel Breaker Plates	Carbon-Steel Bucket Plates	Carbon-Steel Liner Plates	Miscellaneous	Total	Power
Lb./ton ore	0.15	0.10	0.05	0.10	0.40	$0.043

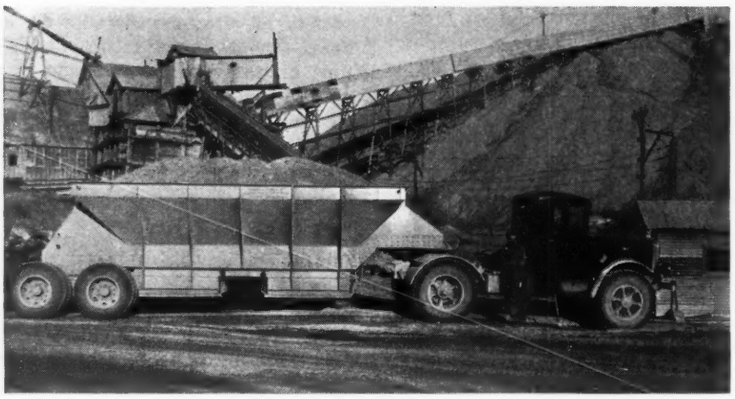
Table III—Crushing and Washing Costs

	Operation		Repairs		Total Cost
	Labor	Supplies	Labor	Materials	Per Ton
	$0.013	$0.004	$0.005	$0.060	$0.125

Truck Transport Serves Tri-State Mining

Tonnage of ore and tailings thus hauled over District's roads continues to increase

W. F. Netzeband
Mining Engineer
Joplin, Mo.



This 25-ton, semi-trailer truck powered by a 150-hp. diesel engine was recently put into service by the Semple Mining Company, hauling tailings two miles to the Early Bird mill north of Treece, Kan. The trailer was designed and built locally

IN 1931 the Commerce Mining & Royalty Company proved the practicability of centralizing the milling of mine ore in the Tri-State zinc and lead district of Oklahoma, Kansas, and Missouri. The idea was adopted soon afterward by tailings re-treatment mills, and these introduced trucks for bringing the tailings to their bins, or hoppers. They developed the 10-ton, semi-trailer truck, described in a previous article.[1] This was soon adopted also for moving ore from small mines to the central or custom mills.

Truck transportation has now become almost universally employed for moving tailings to the re-treatment plants. In November, 1939, approximately 625,000 tons was re-treated and all but about 40,000 tons was carried in trucks. Length of haul has increased, so that the average is now close to 2 miles, and with this development the trucks have come to use the public highways more and more. As many of these roads are gravelled, the heavy traffic soon causes their surfaces to disintegrate. If neglected, this would increase the expense of maintaining the trucks. The counties of the district are not financially able to keep these roads in good condition under this increasingly heavy traffic, and, in consequence, many of the companies using truck transport find it worth while to maintain them themselves by using light graders which can be pulled behind the loaded trucks. As a result, many of the public roads in the mining district are being kept in possibly better condition today under the present heavy traffic that they have to carry than they have been in years.

Cost of transporting tailings has risen slightly in recent months because of an increase in wages of $1 per day granted for all classes of labor. No cost data are available for 1939, but in 1935 the average cost of loading with power shovel and transporting to the mill with truck was $0.0542 per ton and in 1938 was $0.0579 per ton. This cost was divided about equally between the operation of loading and transporting.

Growth of truck transportation of ore is even more phenomenal than that of tailings. In 1935 only an insignificant tonnage was so carried, but in November, 1939, the Central mill of the Eagle-Picher Mining & Smelting Company received an amount that established a record, approximately 250,000 tons, about 60,000 of which was brought in by truck. An estimate has been made that the ore mills of the district handled about 650,000 tons in the same month. Of this total more than 250,000 tons was transported by truck.

For carrying the ore many 10-ton, semi-trailer trucks are in service. These are supplemented by many standard end-dump trucks which range in capacity from 2 to 5 tons. Inasmuch as ore contains a higher metal content than do tailings, the distance it can be hauled economically is proportionally greater. The average ore truck haul is 3 miles, a maximum of 16 miles being reported from one small mine in Missouri. A larger proportion of this haulage work is done on public roads than in the transportation of tailings, and, as in hauling the latter, previously cited, mine operators often find it economical to maintain that portion of the roads so used. In some instances a mining company will maintain as much as several miles of public road.

In 1935 the cost of hauling ore from several points over a distance ranging from five-eighths of a mile to 4 miles, with an average of 1.07 miles, was reported to be $0.0369 per ton. Today, it is estimated, this cost will be closer to $0.05 per ton.

The only recent development respecting the trucks themselves is the recent introduction by the Semple Mining Company of a 25-ton, semi-trailer unit powered by a 150-hp. diesel engine. This truck is hauling tailings approximately 2 miles at present. No comparative cost data are yet available.

Advantages of centralization of milling are now so well recognized that the future should see a larger share of the district's production of zinc-lead ore treated at such plants. Also contributing to this end is the fact that many of the orebodies are being depleted to the point where they will not support individual mills. These circumstances suggest that the use of trucks for the transport of both ore and tailings is likely to show continued increase.

[1] W. F. Netzeband: "Surface Transport of Ore and Tailings," *E. & M. J.*, Vol. 136, No. 12, pp. 601-606, Dec., 1935.

The Jerk Line

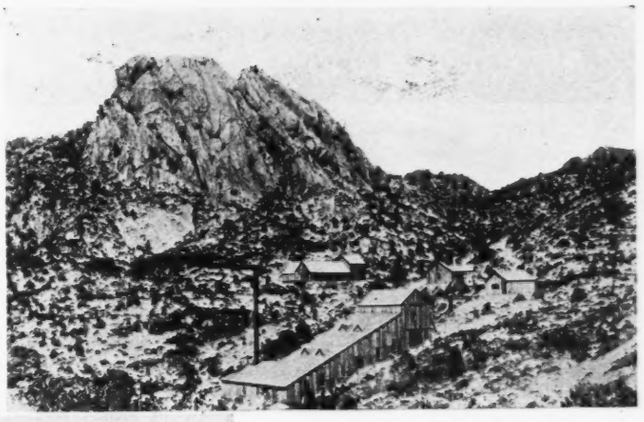
C. J. Hutchinson

"Like the dew on the mountain,
Like the foam on the river,
Like the bubble on the fountain
Thou art gone — and forever."

THE MANNER in which supplies, equipment, machinery, and lumber are transported to operating mines has changed —along with the six-horse stagecoach and the coal oil lamp—from that which characterized the pioneering days. No longer can be seen the heavy freight wagons, with high, thick-tired wheels, generally two at a time, drawn by sixteen to twenty horses, working two abreast, and driven by a single line.

As the drivers of these teams sent them up and down the steep mountain grades, around sharp, dangerous curves and precipitous canyons, sometimes making nearly a right-angle turn, the skill displayed was a fascinating show—today it is almost a lost art. It was accomplished without hurry and excitement and with deliberation, and with full confidence that the wagons were going to track the desired road.

On the left of a span, or team, was the *"near"* horse; the one on the right was known as the *"off"* horse. The positions of the different spans were designated as wheelers; pointers; leaders; swing or sixes; eights, tens, and so on. The wheelers worked next to the wagon, with the tongue between them, and had the responsibility, together with pointers, of guiding the wagon in the desired direction. Wheelers had to be very strong, with pulling ability and intelligence, gentle and obedient. They knew the "feel" of the wagon's action and often when the wagons sank down in a mudhole they would, of their own accord, make a special effort to pull them out. They were also smart enough to take it easy when the going was good, and to al-

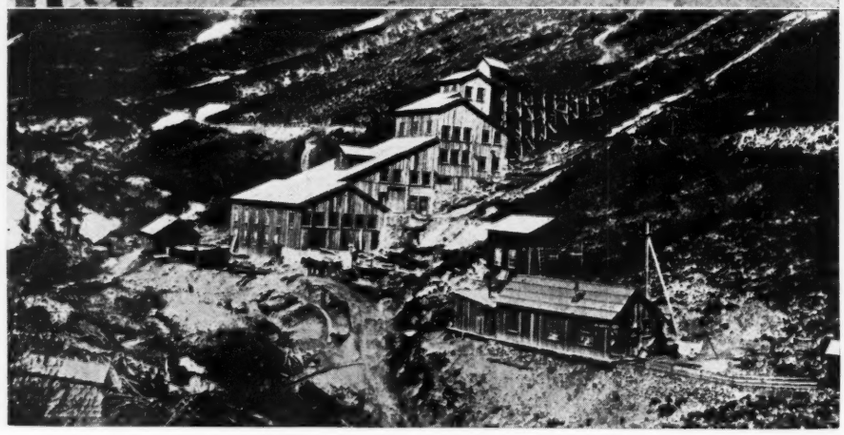


An old quartz mill built alongside the giant ancient granite outcrop

Silver City, Idaho, was a historic, picturesque mining camp—typical of the Old West—with a population made up from every walk of life. Cowboys with high-heeled boots, chaps and jingling spurs; sheep herders with the pungent smell of the corrals; shaggy-haired, callous-handed prospectors; rough miners; gamblers; Indians; Chinamen; saloons. A camp of anything but peace and quiet

The "Mountain Canary" pack train

The arrival of the freight train



The roar of the falling stamps is gone

low the swing teams to pull the load, conserving their own strength.

A span of wheelers especially displayed their intelligence when making a sharp turn. The horse on the side of the direction of the turn would pull ahead, thereby causing the staychain on his side to take the strain, thus preventing the front wheels from being cramped under the wagon. The opposite horse at the same time would hold back on his breast strap, which would help the pointers equalize the strain and gradually guide the wheels to make the turn.

Known as pointers, the second team was hitched to a stretcher bar, which was hooked into rings fastened about eighteen inches from the end of the wagon tongue. Pointers responded quickly to commands and had no fear of going off the road, even in bad places. They were the main assistance to the wheelers in making turns, and guiding the wagon tongue, by stepping over the chain from one side to the other and pulling at the tangent desired. Horses were worked first as pointers, and taught, generally with an individual "jerk line," the principles of pulling on different sides of the main haul chain in cooperation with their mates. They obeyed immediately the voice commands of the driver and also jerk-line signals. After working as pointers, they were advanced into the position of leaders or swing.

Swing teams were not excitable; knew road travel and their position and duty at different points when making turns. Swing teams worked free, except that when not fully trained they were first tied by a halter rope to the stretcher bar, or doubletree, of the span ahead, to help guide them. Without a word from the driver they knew how and when to cross over the haul chain and to pull at the proper tangent.

The leaders were the guide team, and had exceptional intelligence, feared nothing and were eager to work, responding quickly to the jerk-line signals.

All teams were taught that the voice command of "Gee!" meant right and "Haw!" meant left. When a horse was called sharply by name (which he knew well), thus: "Jerry! Haw!" he would step left over the haul chain, or if already over, would pull at an increased tangent to the left.

The jerk line was a single line, or rein, about a hundred feet long, fastened to the near side bit of the near leader and running over the backs of the swing teams to the driver, being guided through "fair-leader rings" attached to the hip strap harness of the swing teams, but free over the pointers. The near leader turned to the left when the line was given a steady pull, and to the right when it was jerked or given a succession of jerks (whence the name). To insure his going to the right promptly at the signal of the jerk, a "gee-line" was fastened from the right side of the hame, or collar, of the harness to the right side of the bit. At the jerk he naturally raised his head and the gee-line would tighten, having the same effect as pulling the rein to the right. To secure and insure control over the off leader a "jockey-stick" and "buck-strap" were often used. The former was a round hardwood rod, sometimes a piece of small iron pipe, four and a half feet long, and fastened from the off side of the near leader, underneath the hame, to a "jib-strap" attached to the bit of the off horse. This would cause the off leader to be pushed to the right, or pulled to the left, as the jerk line signal was given to the near leader. The buck-strap was a split rein attached to both sides of the bridle bit of the off leader and fastened back to the doubletree, which would hold the off leader from advancing too far ahead.

The doubletree of each span of

A cabin asleep by the glassy creek, which reflects the sky and slowly works its reedy way

swing teams was firmly fastened to a long haul chain, made up of a series of chains and known as a "fifth chain," which extended from the front axle of the first wagon to the leaders' stretcher bar.

In a saddle on the near wheeler sat the driver or "mule skinner," holding the jerk line and, in his left hand, the line that controlled the brake which was attached to a ring fastened back of the cantle of the saddle. He had a six-foot "shot-loaded" whip, called a "black snake," which hung loosely over his shoulders and around his neck. This had an Indian tanned buckskin "popper" at the end, and, when skillfully cracked, would make a report as loud as a discharged six-shooter. The drivers became expert with it and

could flick a bothering, biting fly off a horse's back without touching the animal. The man who drove spirited Percheron greys hitched to a big, smooth-rolling wagon, or light, praneing, well-groomed sixes from the seat of a tallyho, may have been considered a crack driver, but to liken him to the man handling sixteen to twenty horses with but a single line is like comparing the commander in the pilot house of a palatial, trim yacht on a smooth lake, with the skipper on the hurricane deck of a sea-scarred whale-ship in an Arctic storm.

When the teams were in bad places, or on a steep pitch in the grade, where every horse had to do his part and exert his full strength, the driver, before attempting the pull, would dismount and go up and down the line of horses, talking to them, giving them encouragement. They understood they were being asked to make a special effort. They were not started by one command, but, instead the driver first gave a long, loud, drawn-out "Yeah" (by some accompanied with a high-pitched, hissing whistle), whereupon all the spans would settle forward in their collars, tightening up their chains as firm as iron bars. Then with a sharp "Yo" and the loud crack of the whip, they would all pull together. You would have admired the skill of horses and driver.

Bells were used on the freight teams and were an aid in giving notice to approaching traffic around curves and on narrow roads where passing would be difficult. The bells were worn by the leaders on the top of their collars, generally arranged on a semicircular bracket and consisting of five graduated sizes, which gave a tingle-chime tone.

Often, after a rest, the driver would have his leader shake his bells, trained to do this at a given signal from the jerk line, and all the horses learned to respond at the jingle, stepping up to "tighten the rigging" and preparing for the signal to start. The drivers had pride in their bells and often used them as a trophy, it being the custom, if it were necessary to call for a helping pull, to forfeit them to the helping team. The bells were sometimes wagered in contest pulls. The driver also carried a can of rocks in the "jockey-box" of the wagon to "wake up" his horses, and could throw them with the accuracy of a baseball pitcher.

A feed of grain and hay (water was carried in barrels attached to the side of the wagon) was necessary unless on well-established short routes. When hay was fed, it was placed on the ground and helped to keep the teams quiet and resting. Grain was given in nosebags. The less gentle teams were unhitched and secured around the wagon before they were fed. The

The old boarding house with the huge platters of meat, big dishes of steaming potatoes, deep bowls of gravy, all in the center of the table, has passed, along with the coal oil lamp, six-horse stage, and jerk-line freight

In places the winding road is almost obliterated

In full swing along the creek road bed

Every tug and chain as taut as an iron rod as they pull together up the dusty lava-lined canyon

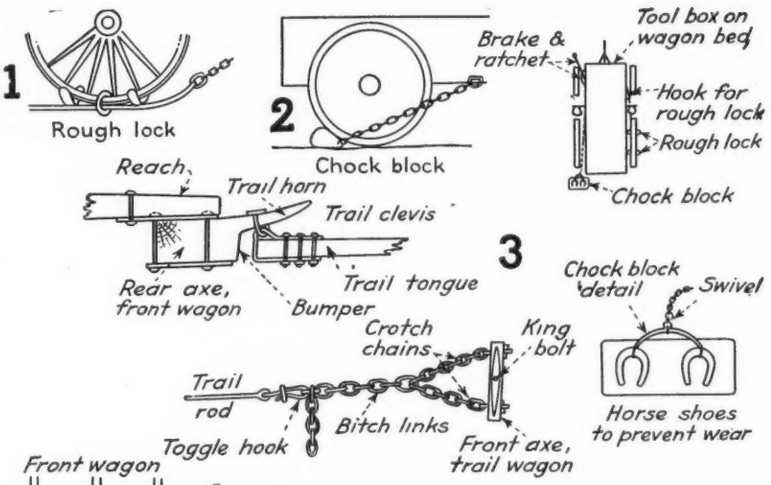
Asleep in the lap of legends, desolate, deserted

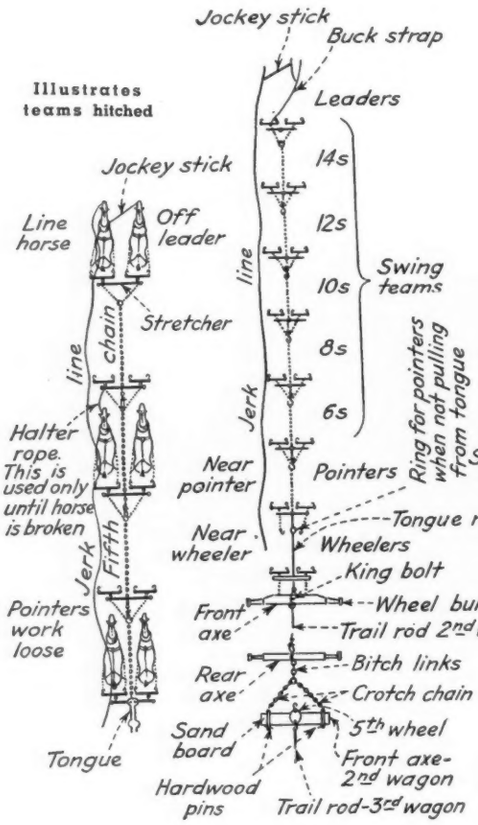
Across the desert sagebrush waste

1 A roughlock, or wheel "shoe," used to assist the brakes when going down steep grades. It was always put on the low side of the road, as it would crowd the wagon uphill

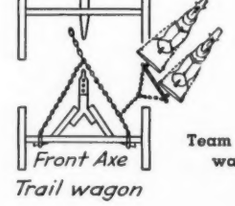
2 View of the chock-block, used (on rear trail wagon) when going uphill to hold the wagon from going backwards when the teams stopped to rest. The driver applied the ponderous brakes, by pulling on a rope, generally run through a block and tackle to give purchase power, attached to the heavy brake handle, then gradually allowing the rear wagon to rest back on the chock-block

3 Detail of trail wagon hook-up. The term "dropping a link" was used when links of the "hitch-chain" were lengthened, by opening up the toggle to permit the lead wagon to be in motion before the strain came, necessary to start the trailer

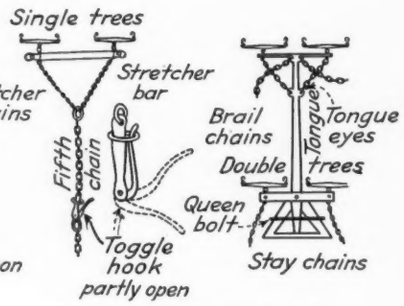




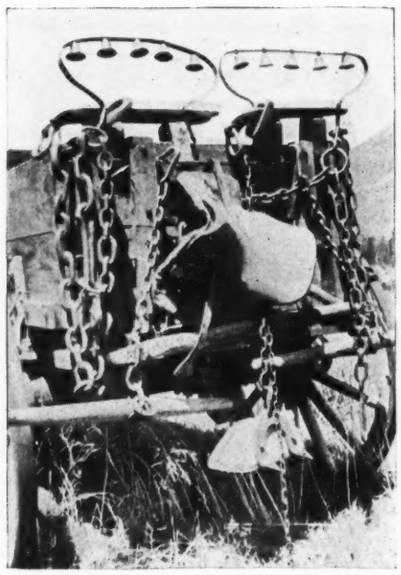
Detail from wagon to leaders



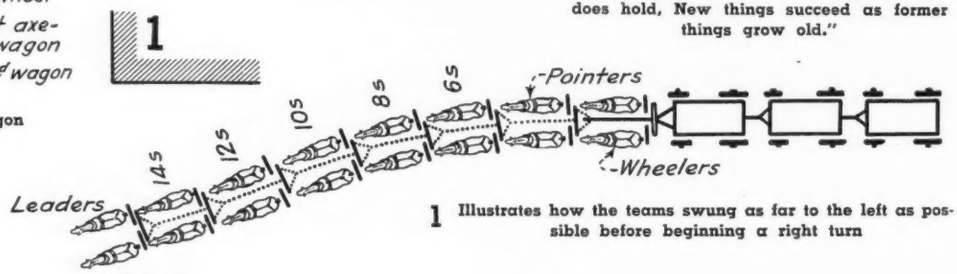
Team making trail wagon hook-up



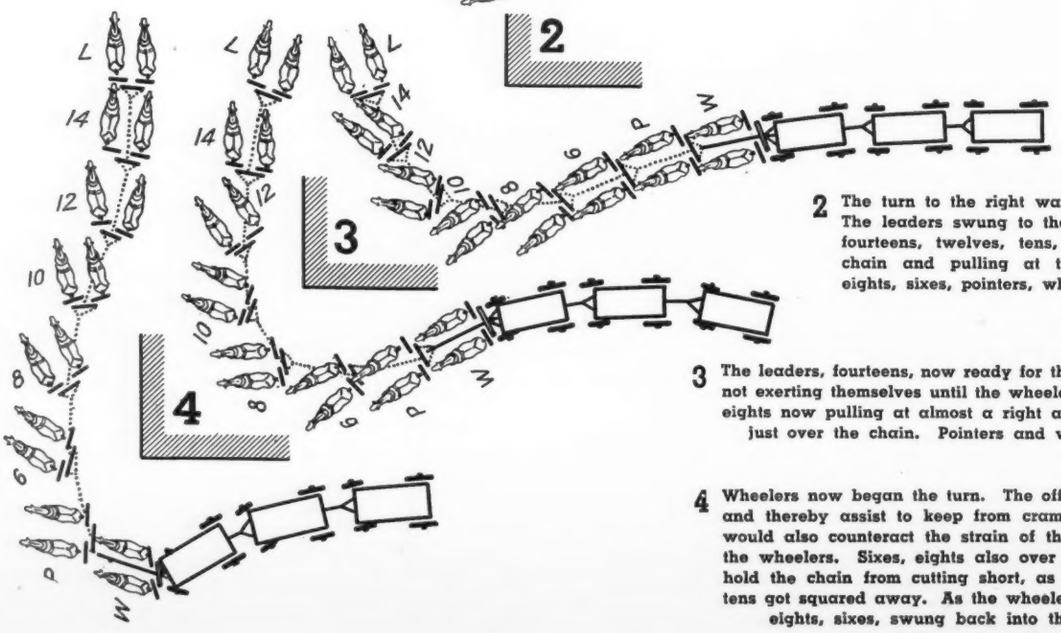
Detail of toggle hook and wagon tongue



"Thus times do shift—each thing his turn does hold, New things succeed as former things grow old."



1 Illustrates how the teams swung as far to the left as possible before beginning a right turn



2 The turn to the right was started, by jerks on the line. The leaders swung to the right, the off horses of spans fourteens, twelves, tens, stepping left across the fifth chain and pulling at their respective tangents. The eights, sixes, pointers, wheelers continued to pull to left

3 The leaders, fourteens, now ready for the pull in the new direction, but not exerting themselves until the wheelers had reached the turn. Tens, eights now pulling at almost a right angle to the left. Twelves, sixes just over the chain. Pointers and wheelers still in old direction

4 Wheelers now began the turn. The off wheeler would advance ahead and thereby assist to keep from cramping the wheels. The pointers would also counteract the strain of the fifth chain by swinging with the wheelers. Sixes, eights also over the fifth chain to pull left and hold the chain from cutting short, as the leaders, fourteens, twelves, tens got squared away. As the wheelers negotiated the turn, pointers, eights, sixes, swung back into their places and carried on

Open-Pit Transport on the Mesabi Range

VII—The advantages of truck haulage grow in economic importance as makers continue to build more and more powerful units in rugged models for the severest service

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THE HISTORY of truck haulage on the Mesabi and Cuyuna ranges of Minnesota, in the Lake Superior Iron Country, was well presented in an article by R. W. Whitney and Grover J. Holt in *Engineering and Mining Journal* of January, 1939, which not only showed the progress made in the development of this form of haulage up to that time, but gave in detail the mistakes, tests, and experimentation that one iron-mining company went through to prove what was the best equipment for its work. Inasmuch as other operators naturally seek to avoid repeating the same mistakes, all new 15-ton trucks purchased for use during the 1939 shipping season were of the six-wheel end-dump type and not the ten-wheel type with the side-dump body. The only improvement made in the body as compared with the 1938 design has been the omission of the down-folding tail gate. The view of the truck with its body in dumping position shown[1] in Fig. 7 reveals how it has been possible to do this. The side view shows how the body bottom can be raised to a dumping angle of 70 deg. with the horizontal, in this way being self-cleaning.

Other new improvements made in engines and in truck designs were tried out in a preliminary way in the ore-moving field during the 1939 season. At the Mahnomen mine, on the Cuyuna range, a fleet of six 15-ton Dart trucks, built in Kansas City, Mo., has been hauling ore since last May. These machines have the appearance of the six-wheel Euclid trucks that were shown in the article published in the January, 1939, issue of *E.&M.J.*, already referred to, but the details of construction are radically different. A 200-hp. engine using diesel oil fuel is employed instead of the 150-hp. engine which powers the other truck. With the greater horsepower the Dart truck can climb a 10 per cent grade fully loaded at 11 m.p.h., instead of at 5 m.p.h., thus giving a 50 per cent increase in the tonnage hauled in the same time. The Dart body is supported on elliptical springs, in contrast with that of the other truck, which is carried on rubber. One maker claims the springs give more life to the tires, whereas the other

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THE JERK LINE

(*Continued from page* 37)

accompanying sketches explain the manner in which the horses were harnessed, hitched, and driven, and the detail of how the wagons were hauled, controlled, and hooked together.

O Time and Change!

Today the fast, powerful motor-driven trucks will haul the loads ten times as fast. There is no longer the night camp in a clump of cottonwoods with the cool spring water running through an old iron pipe into a long watering trough which the tired, dusty, thirsty horses so welcomed. The cross-pole corral that gave an opportunity to roll and rest is gone.

And the mining camps—

"Sunk are thy bowers in shapeless ruin all
And the long grass o'ertops the mouldering wall."

Today the buildings and homes, with smokeless chimneys, are brown with age and lack of paint, fallen and deserted.

The present fades; the past rises. Yesterday the streets were a scene of hustling, bustling humanity; swinging saloon half-doors; boisterous laughter; pounding pianos; click of faro chips; turn of roulette wheels; "stud poker"; "black jack"; the sheepherder against the cowboy; the hard-rock miner against the gamblers, mule-skinners.

Today everything is silent, barren, desolate, forlorn. The church on the hilltop is boarded up and no cross of candles burns in the window. In the joss house, where the Chinese burned their sticks of incense and paid homage to their gods, now lives a lone Chinaman, eking out an existence by packing stovewood to a few remaining inhabitants.

No freight wagons are heard creaking beneath their heavy loads. In places the winding road is almost obliterated. The rusty red smokestacks of the abandoned quartz mills have tumbled down and the roar of falling stamps is gone.

A coyote will send forth a shrill, weird, human-like wail—then again the intense silence. The bleating of a flock of sheep can be faintly heard in the distance; or, at night, the distant howl of a ranch dog as he bays the brilliant moon.

But the air still holds the sweetness of the sage, juniper, and wild rose. A plumed, chattering, friendly magpie will still follow you from telegraph pole to telegraph pole along which is now strung but a solitary wire. A hammering woodpecker, tapping on a dead tree, makes the same hollow, booming sound. A sage hen will rise suddenly from the edge of the road. A cottontail deer will run up the mountainside. A bald eagle will circle overhead. But you will *not* hear the rumbling freight wagons nor the clanging trace chains and tinkling bells of the sixteen-horse teams, nor the "Yeah Ho!" of the picturesque drivers being echoed back and forth through the rugged mountain canyons, gorgeous with shades of green, on the winding roads to the colorful mining camps of the Old West.

(I wish to acknowledge my appreciation to George F. Riddle, of Boise, Idaho and Gilbert Fleming, of Hailey, Idaho, for very helpful data; and to R. S. Penrose, of Seattle, Washington, for detail sketches.)

Fig. 7 . . . Two views of an Euclid truck with body in dumping position. Note how the design does away with the down-folding tail gate. When in the normal position for running, the body rests on four cylindrical rubber pads on the steel side members

Fig. 8 . . . Rear end of a Model 120 Dart truck with body in dumping position. Note that the truck is equipped with elliptical springs

holds that rubber support reduces the truck body side-sway on rough roads, and that, therefore, the tires last longer.

The Dart truck uses a fluid coupling between the engine and rear transmission which relieves the rear transmission and axles from severe strains and shocks and cuts down breakage and repairs to these parts.

The following technical details covering the traction-type hydraulic coupling are taken from a description by Will H. Fullerton in the August, 1939, issue of *Diesel Progress*:

"The original Vulcan hydraulic coupling, a development of the Fottinger speed transformer, was first used commercially in Europe in 1923 as a means of connecting high-speed diesel engines to propellers through reduction gears. During the last fifteen years more than 1,000,000 hp. have been installed throughout the world, ranging in size from 1 to 26,000 hp. The traction coupling, first introduced in England ten years ago, differs from the marine and variable-speed types in that it is a self-contained unit in which no provision is made for adding or removing fluid while in operation. Such a coupling . . . resembles the conventional friction clutch in external appearance.

"This coupling consists of a radially vaned impeller, a similarly radially vaned runner, and an inclosing cover. The impeller is connected to the engine and the runner to the drive shaft of the truck through the 'Lipe' friction clutch and 'Fuller' gear box. These two rotating members face each other but are not connected mechanically. The cover, which incloses the back of the runner, is bolted to and rotates with the impeller. Power is transmitted by the kinetic energy of the fluid, usually light turbine oil which circulates automatically by centrifugal action between the radial passages formed in the two rotating members. Due to the absence of any mechanical connection between the driving and driven member, the hydraulic coupling is completely effective in preventing the transmission of torsional vibrations and shocks from the engine to the truck or from the truck to the engine.

Fig. 9 (in this issue) "shows a cross-section of a traction coupling in which the coupling is carried by the engine flywheel. Arrows indicate the flow of the liquid between the impeller (1) and the runner (2). The cover (3) inclosing the back of the runner to retain the working fluid is bolted to and rotates with the impeller. The reservoir (4), on the back of the runner and connected to the working circuit by core tubes, serves as an expansion and deaërating chamber. During starting, part of the oil from the working circuit is transferred to the reservoir (4) and thus permits the engine to start up under very low load and gradually pick up its load as it increases speed.

"One of the most important features of the hydraulic coupling is its ability to prevent engine stalling when overloads occur, as, for example, when the heavily loaded truck hits a heavier grade than it can negotiate. When the engine is running at full speed and developing normal torque, the coupling slip is in the neighborhood of 2 per cent, but as the engine slows down, due to overload, the slip increases until it reaches a value of 100 per cent at 30 to 50 per cent of engine speed. As there is no loss of torque in the hydraulic coupling, full engine torque is delivered to the rear axle and the engine continues to run at reduced speed until this overload is relieved by shifting to the next lower gear, when the engine again picks up speed and the coupling slip returns to minimum. This fluid flywheel has 100 per cent slippage at 600 r.p.m. of the motor and at 1,600 r.p.m. it has only 2 per cent slippage."

A similar drive has been adopted for the Oldsmobile automobile in the 1940 model. The Euclid maker claims that no such clutch is needed, as the company's transmission is built so strong that the rear wheels can be bolted solid to the ground, the transmission changed through all its steps with the engine at full speed, and that the engine will die from overload before any part of transmission will be injured.

Other minor differences embodied in chassis construction, automatic cut-out of cylinders when the engine idles, and other points, are also being watched, but the three main differences outlined in the foregoing will determine the styles in ore trucks for the 1940 season.

Using time-cycle study results as given in the article by Whitney and Holt (*E.&M.J.*, Jan., 1939), a comparison of haulage costs has been prepared covering the "average pit" discussed in previous articles. The truck road is assumed to be on the same location as the double railway track line between the pit and the washing plant shown in Fig. 10 (this is the same as Fig. 1 on page 54 of *E.&M.J.* of November, 1938) and extending this road into the pit on a 9 per cent grade as in Fig. 11 (this is the same as Fig. 4, page 48 of *E.&M.J.* of March, 1939). The quantities of ore are the same as shown in the following basic data:

Maximum quantity of ore per hour, long tons	625
Total number of 8-hour shifts per ore season	240
Total number of hours per ore season	1,920
Loading shovel used	4-cu.yd. Bucyrus Erie
Total haul, ft	18,500
Nine per cent grade, ft	1,440
Total lift, ft	257

As outlined in the article by Messrs. Whitney and Holt, truck speeds for estimating purposes may be computed as in Table XVIII.

The figures given in Table XVIII, XIX, and XX are based on the assumption that the road will be maintained in first-class condition by road patrol and sprinkler. The better the road, the lower the haul cost.

On the basis of the cost comparison given in Table XVII, the haulage cost using trucks is close to 2.4 times the cost of using electric lorry trains. But such figures tell only part of the story. They show that by the application of trucks for open-pit haulage, ore can be brought out of the pit on grades of 8 to 10 per cent, whereas the long haul on level ground can be performed at less expense by electric haulage. The only way to bring trucks into the picture on long haulage is to build them equipped with larger engines constructed to use cheaper fuel and for faster speeds on level roads.

These improvements are embodied in the 15-ton Dart truck in use at the Mahnomen mine. This machine is equipped with a $6\frac{1}{4}$-in. bore by $6\frac{1}{2}$-in. stroke six-cylinder engine, built by the Waukesha Motor Company, that will operate on diesel, gasoline, or butane fuel. At 1,700 r.p.m. it develops 200 hp. on diesel oil or 235 hp. on butane. This additional horsepower gives 11 miles per hour on a $9\frac{1}{2}$ per cent grade with diesel fuel and the same speed on a 10.9 per cent grade with butane. The quantity of fuel consumed is 50 per cent greater than that required for the 150-hp. Cummins engine in the Euclid truck. The Euclid Company expects to increase the horsepower of its engine for the 1940 season by adding a supercharger to the present engine. This test is being run.

The Dart Company equipped one

Table XVIII—Truck Speeds and Hauling Time Cycle

Level hauls, loaded, max. m.p.h.	10
Down grades, empty, max. m.p.h.	10
Upgrade, 5 per cent, m.p.h.	8
Upgrade, 7 per cent, m.p.h.	6
Upgrade, 10 per cent, m.p.h.	5

Hauling Time Cycle

	No. 1 (Euclid), Min.	No. 2 (Dart 120), Min.	No. 3 (Dart 300), Min.
Loading	1	1	2
Haul 1,440 ft., 9% grade	3.5 at 5 m.p.h.	1.49 at 11 m.p.h	2.8 at 6 m.p.h.
Haul 17,060 ft., 2% grade	19.5 at 10 m.p.h.	7.75 at 25 m.p.h.	9.7 at 20 m.p.h.
Return 18,500 ft.	13.2 at 16 m p.h.	8.40 at 25 m.p.h.	10.5 at 20 m p.h.
2 turns and 1 dump	1.5	1.5	1.5
Total	38.7	20.14	26.5

Table XIX—Estimation of Number of Trucks Required for Handling 625 Long Tons

Electric Operation versus Truck Operation

	No. 1 (Eculid)	No. 2 (Dart 120)	No. 3 (Dart 300)
Round trips per 50-min. work hour	1.29	2.50	1.89
Long tons per load	15	15	30
Long tons per truck-hour	19	37.50	56.5
Number of units for 625 long tons per hour	32	17	11
Standby trucks required	3	2	2
Total trucks required	35	19	13

Table XX—Truck Ownership and Operation Expense

	No. 1 (Euclid)	No. 2 (Dart 120)	No. 3 (Dart 300)
Price per unit delivered	$12,000	$12,000	$16,000
Depreciation period		Four years or 10,000 hours	
Hourly expense:			
interest, tax, at 6%	0.29	0.29	0.49
Depreciation $\frac{12,000}{4x1920}$	1.56	1.56 $\frac{16,000}{4x1920}$	2.08
Fixed charges total per hour	1.85	1.85	2.57
Tire and tube replacement 8,000 miles per set	0.60	0.60	0.90
Mechanical repairs and replacement	0.50	0.50	0.75
Diesel fuel oil, 25 gal. per hour at 8.5¢ per gal.	0.21 (40 gal.)	0.34 (60 gal.)	0.51
Crank-case oil, 15 gal. per hour at 50¢ per gal.	0.08	0.10	0.15
Hoist oil	0.02	0.02	0.03
Grease and labor	0.10	0.10	0.15
Driver	0.80	0.80	0.80
Operating expenses	2.31	2.46	3.29
Total hour expense	4.16	4.31	5.86
For 32 trucks (32 x $4.16)	133.12(17x4.31)	73.27(11x5.86)	64.46
3 standby at $1.85	5.55(2 at 1.85)	3.70(2 at 2.57)	5.14
Total hourly expense	138.67	76.97	69.60
1,920 hours per season	$266,246.00 (1,920x76.97)	$147,782.00	$133,722.00

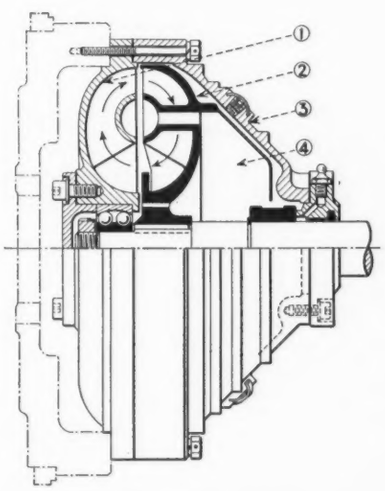

Fig. 9 . . . Traction coupling in cross-section. This drawing is reproduced from an article by Will H. Fullerton in the August, 1939, issue of *Diesel Progress*

Table XXI—Summary and Comparison of Haulage Costs in an Open-Pit Mine

Electric Operation versus Truck Operation

Summary	
15-ton Truck Operation	
35 trucks	
Capital Investment	
35 trucks at $12,000	$420,000
3.5 mile road at $6,000/mile	21,000
1-80 hp. tractor bulldozer	7,500
1 road patrol	6,000
1 sprinkler	2,000
Total	$456,500
Operating Expense	
Electric power for pit shovels and washing plant	$47,227
Total expense for season to operate 33 trucks as listed in detail	266,256
Total operating and fixed charges	313,483

Summary	
Electric Lorry Operation	
3 trains	
Capital Investment	
3-3 car trains at $55,000	$165,000
10 mile distribution system at $5,000/mi.	50,000
10-mile track system at $12,000/mi.	120,000
1 substation, 750-kw. capacity	42,000
Total	$377,000
Operating Expense	
Electric power for pit shovel and washing plant	$47,227
Electric power haulage	9,300
Total electric power	$56,527
Train maintenance	3,445
Crew wages:	
Locomotive runner	8,316
Brakeman	5,250
Lubricants	50
Electric maintenance	8,620
Total	$82,208
Fixed charges at 13%	49,010
Total operation	$131,218

15-ton truck of the six trucks in operation to use butane gas. As a fuel this is proving satisfactory. One objection raised to butane is that at freezing temperatures on the thermometer it

also will freeze. This can be overcome by the simple means of adding propane gas in proper proportions, whereupon the fuel will perform satisfactorily at 40 deg. below zero.

This fuel is something new on the ore ranges. It is so highly volatile that most of it has been wasted at the oil refineries in the past, but Phillips Petroleum Company now conserves it and has developed a system for its use that makes it as practical as gasoline. The fuel is held under a pressure of 80 p.s.i. For cold-weather operation where it is mixed with propane the pressure must be increased to 200 p.s.i. Due to cold weather conditions on the ranges, all storage equipment will be built for 200-lb. pressure. At present prices butane costs about 8.5c. per gallon at the mine. For using in carload lots a storage system at the mine will cost approximately $3,500, but this expense should be absorbed in two years from the improved haulage operation of the trucks. Propane has a boiling point of —51 deg. F.; butane boils at +31 deg. F. A mine operator can secure a contract for his fuel for an initial period of from one to three years, and the contract will contain five optional one-year renewal periods, as a result of which he can protect himself on fuel cost for a period of eight years.

Table XXII—Operation With 19 15-ton Trucks, Including 2 Standby Trucks

Capital Investment	
19 trucks at $12,000	$228,000
3.5 mile road at $6,000 per mile	21,000
1 80-hp. tractor and bulldozer	7,500
1 road patrol	6,000
1 sprinkler	3,000
Total	$264,500
Operating Expense	
Electric power for pit shovels and washing plant	$47,227.00
Total expense for season to operate 19 trucks as listed in detail above.	147,782.40
Total operating and fixed charges..	$195,009.40

Table XXIII—Operation With 13 30-ton Trucks, Including 2 Standby Trucks

Capital Investment	
13 trucks at $16,000	$208,000
3.5 mile road at $6,000 per mile	21,000
1 80-hp. tractor and bulldozer	7,500
1 road patrol	6,000
1 sprinkler	2,000
Total	244,500
Operating Expense	
Electric power for pit, shovel, and washing plant	47,227
otal expense for season to operate 13 trucks as listed in detail in column No. 3 of the calculations	133,722
Total operating and fixed charges....	$180,949

To demonstrate the savings that can be expected from using the 15-ton trucks developed up to Jan. 1, 1939, and the improvements secured during the 1939 ore season, column No. 2 was added to the calculation of the hauling-time cycle (Table XVIII, also see Tables XIX and XX), which shows a reduction in operating expense of almost $119,000 and a reduction in capital investment of $192,000 (See Table XX). This changes the summary in Table XXI for trucks as given in Table XXII in the adjoining column.

Though this shows that there is still a saving of almost $64,000 by using electric haulage, it is a much better picture for truck haulage than that afforded by the difference of over $182,000 in favor of electric haulage obtained when using the truck with a 150-hp. engine, and it shows why the trend is toward trucks of larger capacity and greater horsepower. Using a truck of still larger capacity and the same horsepower, as done in column No. 3 of the calculations, a better comparison can be shown. This truck, listed as Model 300, will be one of the new models for 1940 and will carry 30 long tons (of iron ore, without "side boards") and sell for less than $16,000. This changes the calculations of Table XXI as shown in Table XXIII. The difference drops another $15,000 and shows that the unit needed to make the desired truck is a 300-hp. engine of the same construction as the 150-hp. Cummins or the 200-hp. Waukesha. The coal- and ore-hauling operators are waiting for it, but so far no maker can see his way clear to spend over a million dollars for tools to place it in production, due to the limited market for an engine of such a size. The coal companies tried to correct the trouble by placing two 200-hp. engines side by side under the hood and attaching them to electric generators

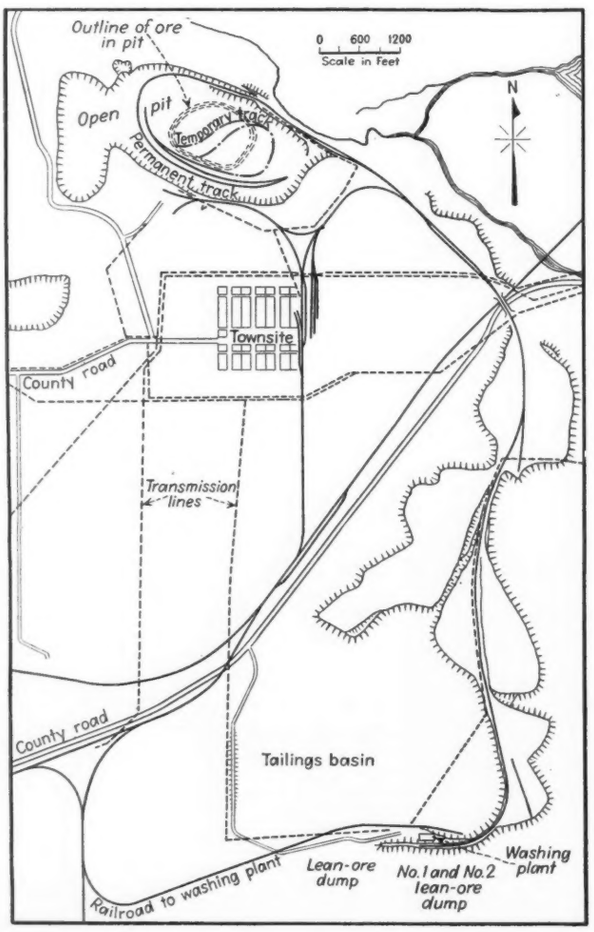

Fig. 10 . . . Surface map showing the location and vicinity of what is an average pit on the Mesabi range. (This is the same pit as that shown in Fig. 1, page 54, November, 1938, *E.&M.J.*)

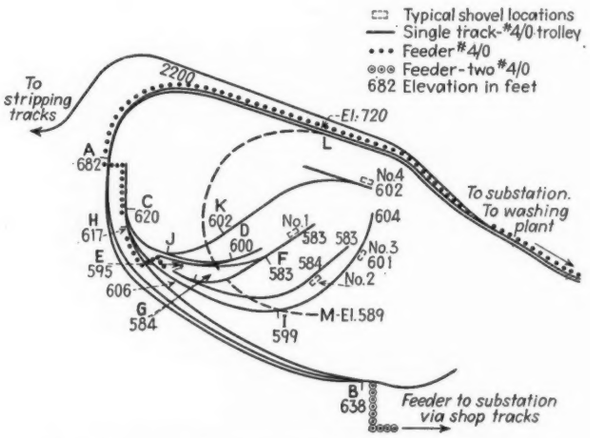

Fig. 11 . . . The truck road considered in the accompanying comparison of haulage costs is assumed to be in the same location as the railroad line here shown running from the pit to the washing plant and extended (shown as a broken line) into the pit on a 9 per cent grade. (This cut is the same as Fig. 4, page 48, March, 1939, *E.&M.J.*)

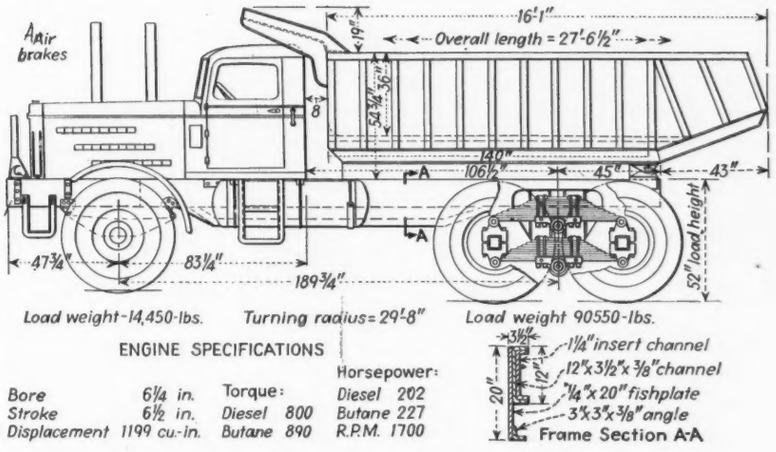

Fig. 12 . . . Side elevation of the new Model 300 Dart truck. This truck weighs 29,230 lb. and will carry a pay load of 61,470 lb.

which drove motors attached to each trailer wheel and controlled through the cab, shown in Fig. 13, but the electrical losses were greater than expected. Several other ideas are simmering, and the solution to the problem should be forthcoming before long.

Though the figures show a substantial saving by using electric haulage of the type specified, several other considerations should be mentioned to complete the discussion. One of the most important is the greater amount of work required in starting a new stripping job by using electric haulage. It is necessary to expend at least 3,000 man-hours before any yardage can be moved, compared to about 300 man-hours with a truck job. If equipment must be moved from one mine to another, because of a change in ore quality, a quick change can easily be made with small loss in time when trucks are used.

Objection has been raised to truck haulage because of the inability of trucks to operate during wet weather. Experience has shown that once the road is built and packed so that water does not soak in, no difficulty is encountered. The expense of building a road is not great and the more the truck operates over it the better the road. A road can be built so cheaply that with truck operation one portion of the pit can be cleaned and dumped in a second portion.

With the use of trucks narrower cuts can be taken by the shovel, which reduces the swing and increases the loading efficiency by 20 per cent. With electric haulage it is necessary to take wide shovel cuts to keep the cost of relaying tracks at a minimum.

The life of a truck is still assumed at 10,000 hours, inasmuch as tests so far have not determined the age of trucks for discard. The Euclid truck was developed by moving a large yardage of dirt and rock by contractors, and all weak points have been eliminated by correcting them as they appeared. Two accidents on the range the past summer proved their ruggedness. At one pit, during a wet period, a section of the road slipped out from under one truck, which slid with the dirt for 40 ft., and then rolled over three times before reaching the bottom. It was set back on its wheels, washed off with a hose, and was found in good condition, with only a cab glass broken. The driver was killed while trying to climb out of the cab. In the other case the driver stopped his truck on an incline by the shovel, left the engine running, and got out of the cab. When the shovel dropped a dipperful of ore into the truck, it started down the incline and fell head-first over a vertical bank 60 ft. high. It turned over in its fall and landed on the cab and front end. When dismantled, it was found that the frame cab and radiator had to be replaced but that the box wheels, tires, and engine were in good condition. After $2,500 had been spent on the truck, it was ready to operate.

The open-pit coal mines have had more experience with truck haulage than have the iron mines. They are now using trucks hauling 50 tons of coal and claim that the economical limit of haul by trucks is about 5 miles one way. If the iron mines of the Mesabi and Cuyuna ranges are to equal this, larger trucks than those now used must be introduced.

Fig. 13 . . . An experimental haulage unit tried by a coal company. Under the hood are two 200-hp. engines, side by side, each driving a generator which supplies current to motors attached to the trailer wheels. The electrical losses are reported to have been greater than anticipated

[1] Figs. 1 to 6, inclusive, appeared in previous instalments, likewise Tables I to XVII. The earlier contributions by Mr. Moore have been published as follows: Part I, October, 1938. Part II, November, 1938. Part III, December, 1938. Part IV, January, 1939. Part V, March, 1939. Part VI, July, 1939. Part VII, in this issue, completes the series discussing the problem of transportation in open pits from the engineering viewpoint.

▼ ▼ ▼

Atlanta District Studied, in Idaho

ALFRED L. ANDERSON is the author of Pamphlet No. 29 of the Idaho Bureau of Mines and Geology (Moscow, Idaho), which deals with the geology and ore deposits of the Atlanta district in Elmore County, in that State. This recently active gold and silver camp was the largest producer of gold in Idaho from 1932 to 1935, inclusive. Discovered in the early sixties, the district has experienced several booms, the latest through the activities of the St. Joseph Lead Company, and has produced ore valued at $6,000,000, of which at least $2,500,000 was mined between 1931 and 1936. It won early fame through the richness of its silver ores, but most of the wealth has been obtained from gold.

Much of the ore mined in the early days was in the form of rich bonanzas, mostly within 200 ft. of the surface. During the recent boom, the mill heads averaged slightly less than 0.5 oz. of gold per ton and 1 to 2 oz. in silver.

Ore deposition was epithermal and was accompanied by extensive silicification of the country rock. The deposits lie along a zone that extends northeasterly through the Idaho batholith. They occupy prominent shear and fracture zones, the principal fracture zone being occupied by the Atlanta lode, the largest and most productive. This has been traced more than two miles and is 40 to 120 ft. wide, but the ore appears to be confined to shoots of exceptional porosity. The main shoots have been bottomed 400 to 800 ft. down. Deeper development has not led to discovery of other shoots.

ORE THEFT

II—Further reminiscences and anecdotes

T. A. Rickard
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IT WILL BE SAID that the temptation to steal gold is hard to resist. Can it be stopped by giving high pay to men engaged in extracting it where theft is easy? When 23 years old I had charge of a pocket mine near San Andreas, Calaveras county, California. The pockets were found at water-level, 120 feet below the surface, where small cross-veins came into the main vein. Only one man was employed in seeking and exploiting these pockets, while thirty other men were employed in mining the main lode of low-grade ore. To the pocket miner I paid $200 per month at a time when standard wages were $2.50 per day. It was my belief that by giving such high wages, the miner, a respectable and elderly Welshman, would be faithful to his employer, the company for whom I acted as manager. Of course, I made frequent visits to the place where he worked and usually assisted him in removing the gold whenever a pocket was uncovered. Did he steal? I think not.

However, such trust may be misplaced. The owner of the Black Oak mine, in Eldorado county, paid his men 50 cents more than the current wages; he gave them a bonus of $200 per annum, and provided health insurance for both the miners and their families. Nevertheless an investigation disclosed the fact that $60,000 of gold was stolen. Nearly the entire force of 26 men was arrested. Seventeen of them pled guilty and were given 90 days in prison, with five years probation, during which they had to make restitution. Two men stood trial, they were convicted by a jury and were given an indeterminate sentence of 1 to 14 years in San Quentin prison. This means that they would get out, if they behaved, in two or three years. Apparently no restitution was required of them. A misdemeanor is outlawed in a year by the statute of limitation. Thus the men were able to escape a heavier penalty by antedating their theft. This seems to confirm the old saying that the law is an ass.

In California when stolen ore is traced from the mine to an unprincipled buyer, the officer of the Bureau of Mines usually advises the mine-owner to bring a civil suit against the buyer for the value of the gold, plus 7 per cent interest. This is done by virtue of the old law of conversion whereby one cannot transfer title to stolen property even though bought in good faith. When a buyer has kept his records correctly, but has signed a fictitious name to his affidavit, he is traced by his hand-writing and is sentenced to a year in prison. Even if the buyer is honest, if he buys frequent lots of 'high-grade' from the same client, he is bound to "check up on it", that is to say, make pertinent enquiry, which would disclose that the alleged source of the stuff was fictitious. Federal cases are tried at Sacramento or San Francisco. State cases are tried in a county court, necessarily, but usually owing to the local sympathy of friends and neighbors, it is difficult to obtain a conviction in accord with the evidence.

In 1931 Arthur B. Foote received a registered letter with return address of "A. Man, Sacramento". Enclosed was $2700 in bills, and a note reading as follows: "The enclosed is money borrowed from the Tightner mine in the years 1914 to 1915 now intrusted to you as a stockholder at that time, to divide among you and the rest of the stockholders of those years and it is the hope that none of this will bring the misery it has brought to me. A. Mistake." This was conscience money in requital for the theft of golden ore.

At Goldfield, in Nevada, during its days of maximum productivity, the stealing of ore was an organized business.[3] High-grading was conducted on a lavish scale. The richest ore consisted of the tellurides of gold and silver. To steal such ore was like stealing bullion. Lumps of mineral worth from fifty to a hundred dollars could be picked up in the bonanza mines that gave fame to this hectic mining centre during the first decade of the century. Millions of dollars worth of ore were purloined. Sixty so-called assayers co-operated with the thieves. Such terms as "theft" and "thieves" would have been considered impolite at Goldfield, where these nefarious practices were regarded with cynical indifference until the mining companies realized that their resources were being squandered among workmen that received high wages as well. Their pay ranged from $5 per shift upward. Detectives were put to work and shipments of stolen ore were detained at Denver, Salt Lake, and San Francisco, but the difficulty of identifying the source of the ore usually defeated the law. Moreover, some of the local policemen were in league with the thieves and facilitated the illicit trade in stolen ore. A metallurgic plant, with a small roaster and leaching vat, was found adjacent to the office of the under-sheriff. Scores of bogus assay-offices did a lively business with the thieves, and shipments of their loot were sent to outlying districts, so that they might be returned as the product of other mines. Eleborate schemes were concocted to divert suspicion. Ore was packed into women's trunks and holes in the ground were bought for the purpose of serving as blinds.

Glasscock in his interesting book, 'Gold in Them Hills', tells the follow-

[3] T. A. Rickard, "Mining and Scientific Press," Vol. XCVI, p. 774; 1908.

ing story, which may be only *ben trovato,* but it is typical of the doings that gave Goldfield a spurious fame.[4] A man named George Wright had lost all his money in a gambling game. Unable to borrow more, he announced that he knew where to get further funds. The hour was nearly eleven o'clock, when a shift was coming off duty from the mines. Wright stepped into a dark corner near an assay-office. Soon he saw a man coming down the street with a sack on his shoulder. When he came within reach Wright shouted, "Hands up", and poked the miner in the ribs with a stick, which was mistaken for the barrel of a revolver. The miner dropped the sack. "Beat it!", said Wright, and the miner did so forthwith. Wright then picked up the sack, took it to an assayer, and obtained an advance on the value of the contents. He returned to the gambling-saloon with $2700 in cash, and thereupon resumed his game successfully. The story was told by Zeb Kendall, a local mine-operator. One may ask how a man could carry $2700 worth of ore, for even at a dollar per pound that would be more than a ton. Kendall replied that much of the ore ran up to $100 per pound, which would mean at least five ounces of gold per pound. Again, it was not usual for the assayers to pay cash for stolen ore except at a heavy discount. It was customary for the 'high-graders' to leave their ore with the assayers and collect the next day when they came with another lot, and the previous one had been assayed. Then they received about half what the ore was worth. The spurious assayer got the rest, less transport and smelting charges.

F. L. Ransome, in the course of an investigation made for the U. S. Geological Survey in 1909, says: "It is reported that miners in some cases refused $20 a day on development work in order to accept $5 a day with the opportunity for illegal perquisites in the Mohawk. The extent to which 'high-grading' went on in 1906 is almost incredible. Two shipments of stolen ore valued at $60,000 and $150,000 were seized on the railroad cars . . . It has been locally estimated that over $2,000,000 was stolen from the Mohawk, Red Top, and Jumbo mines alone up to the latter part of 1907. About $250,000 worth of stolen ore was recovered in 1906. The report of the Goldfield Consolidated Mines Company for the year ending November 1, 1907, shows that stolen ore was actually recovered between May 1 and October 1, 1907, to the value of $30,896. T. A. Rickard states that the total stealings from this one company for the year 1907 were fully $1,000,000, and the same conclusion is reached from a comparison of the figures of mine production with those of the mint for that year".

Yes, I did make that estimate in an article published in the 'Mining & Scientific Press' of June 6, 1908. Ransome used the word 'perquisites' for thefts of ore. This euphemism, like the term 'high-grading', suggests the loose morality and the queer notions of property rights that flourished in these western mining communities at that time.

To understand the extraordinary ease with which rich ore was stolen at Goldfield, it is necessary to have some knowledge of the peculiar labor conditions prevailing in this part of Navada during the period when the bonanzas of the Mohawk, Red Top, Combination, and Florence mines were being exploited feverishly. Mining operations usually were conducted under leasehold; the owners of the mines were, for the most part, without previous experience in systematic mining; they did not know where to search for ore, and they lacked capital; so they granted leases to parties of miners willing to work on the chance of striking it rich, and to adventurous capitalists ready to provide the money required for exploration. A tripartite division of control ensued therefore when the owner of a claim leased a part of it to a syndicate or company, and the latter subleased the ground to a party of working miners. The areas controlled by different syndicates or companies were sub-divided into blocks, usually 300 feet long and the width of a claim, 600 feet. In order to stimulate speculation, the lessees organized stock companies, placing the shares on the exchanges of San Francisco, Los Angeles, Salt Lake, and Goldfield.

As evidence of the enterprise of some of these men, I may instance the lease taken by John Donnellan & Co. on the north end of the Red Top. The ground, 600 feet square, was on the south slope of Columbia mountain and near the foot of it. The term of the lease was for 18 months only, and the lessees agreed to sink a two-compartment shaft to a depth of 500 feet. They expected to sink the shaft at the rate of 150 feet per month and to complete it within four months. All the money required for this highly speculative purpose was gathered in three days by the sale of shares. No better proof could be given of the venturesome spirit of the community.

Of a hundred leasing companies organized in 1906 and 1907, fully twenty struck rich ore and made big profits for a time. Most of them started with just enough money to pay the cost of incorporation, and they raised the requisite working capital by selling shares to an eager public. Even half a lease was incorporated. This happened to the Lewis Rogers lease, a half-interest in which was acquired by a company with a million shares. As soon as the promoters had organized their company they would go to a local or State bank and borrow money on their stock, the bank in turn endorsing the scheme as a highly legitimate mining enterprise. In the face of such loose proceedings, is it any wonder that the banks went to the wall not long afterward? The wonderful ore uncovered in the Frances Mohawk, Hayes & Monette, Lewis Rogers, and Little Florence leases sustained the flimsy fabric of fictitious finance until the day of reckoning came in October of 1907, when a Wall Street panic involved the whole industrial structure of the United States, especially the banks. During that crisis all the local banks, save one, at Goldfield shut their doors, and all the local brokers pulled down their stock-boards. The rate of interest paid by the leasing companies was from one to two per cent per month; the bank officers participated in the leases and in the stock deals that ensued. The one essential factor that was necessary was uninterrupted prosperity based upon inexhaustible reserves of ore. That, shall we say, was asking a little too much from such a fickle dame as Fortune.

The ore was rich indeed. In the Frances Mohawk lease at a depth of 200 feet there was eight inches of mineral that assayed $250,000 per ton; it was free gold together with calaverite, the telluride of gold. Pure gold, at that time, was worth $600,000 per ton. The various leases on the Mohawk mine yielded a total of $50,000 per day for 106 consecutive days. One carload of ore that was shipped to the Selby smelter, near San Francisco, weighed 47 tons and assayed 609 ounces of gold per ton, so that the shipment was worth $591,637, that is, more than six dollars per pound. There were many places in the mines where the miners knew they were breaking ore worth $10 to $15 per pound. It was easy for them to steal several pounds of ore. They did. During 1907 not less than $1000 worth of illicit bullion passed daily through the United States mint at Carson, even after the Goldfield Consolidated mines were closed down, so that most of it must have come from the two Florence leases. Only $300,000 worth of stolen ore was recovered during that year, despite every effort to do so. It was most difficult to trace the 'high-grade', because the thieves crushed it at once and so destroyed the chance of identification with the product of any particular mine. Unless identified positively, the legal evidence of ownership was incomplete.

The stolen ore usually was taken to a bogus assay-office, the proprietor of which paid for about half its real worth. Often it was treated by chlorination; first it was roasted in a muffle

[4] C. B. Glasscock, "Gold in Them Hills," p. 116; 1932.

and then it was leached in a barrel with an automatic stirrer. In one instance a plant was raided while it was in operation. The heading, that is, the ore as fed, assayed 260 ounces of gold per ton; the tailing, or refuse after treatment, assayed 15 ounces. Larceny does not wait upon accurate metallurgic treatment. When the owner of this particular place was asked what he intended to do with the tailing, he said that it would be sold to a man that intended to use it for 'salting' — enriching artificially — the oxidized ore of a claim that he expected to sell. Even when the circumstantial evidence of theft was convincing, the local justices were slow to convict. Public opinion regarded high-grading with humorous tolerance, the labor-unions preached a doctrine by virtue of which a little of the rich ore was the miner's perquisite, the rush to become wealthy possessed everyone, and in the excitement of the pursuit the moral law was cheerfully disregarded.

It was an orgy of theft. Regular harnesses were invented for carrying ore under the working clothes of the miners. On reaching the surface they would step heavily from the cage or bucket and stumble slowly on their way homeward without being arrested, although the officials at the mine, as well as the bystanders, knew why they walked so clumsily. On one occasion, for instance, when the men were being hoisted to the surface at the Mohawk shaft, a man came from underground so loaded with concealed ore that, on stepping out of the bucket, he fell. The superintendent saw it and called out: "Some one help that son of a gun". In the Little Florence there was a hoist underground, on the 300-ft. level, and one day the superintendent signalled from a lower level without getting any response, whereupon he climbed up the ladder and found the engineer of the hoist busily digging in the floor of the level, where there was rich ore. He actually was getting ready to blast, and had done so previously. In order to escape detection he would time his blasting so as to coincide with the 'firing' in the adjacent stopes. Thus the explosion that he caused would pass unheeded. In another mine, the foreman happened to walk into an abandoned crosscut and found three carloads of the richest kind of ore lying on a platform ready to be sacked and obviously meant for removal through a disused shaft at the far end of the crosscut. Another foreman happened to strike the food-pail of one of his own shift-bosses with his iron candlestick and noticed a solid sound; he sent the man on an errand to another level; then he opened the food container and found it stuffed with specimen ore.

Frequently the sacks for containing the wedges used by the timbermen were employed for secreting stolen ore. The 'muckers', or shovelers, would manipulate the shovel so as to leave the heavy fine and rich ore on the bottom of the level; as soon as the men in the stopes shouted "Fire!", which they would do ten minutes before igniting the fuse connected with the dynamite, the shovelers seized the opportunity to collect this rich stuff while the shift-bosses and other men were on their way to the shaft or to a safe crosscut.

At one time it was ordered that the men should leave their dinner-buckets at the office. Some of them came on shift with their food in paper bags, so as to avoid going to the office. They were warned not to do so. The next day all of them came with paper bags, and the manager did not dare to dismiss them. Finally, I may relate the story of the foreman that caught a man loaded with ten pounds of 'high-grade'; this foreman was notified by the secretary of the Miners' Union that there was a watchman to do the watching and he (the foreman) had better restrict himself to his proper duties, otherwise the Union would have something to say!

Thus we come to the root of all this nefarious business: the subservience of the lessees to the labor-union. Why? Because the ore was rich, the time to remove it was brief, the lessees could not afford to delay the extraction of the ore by having trouble with the men during the period of their short leases. The miners knew it, and therefore stole as much as they could as long as they could. Everything was sacrificed in the mad rush to make money: the mines were gutted, honesty was swept aside contemptuously, the law was made ridiculous.

The rights of property were not respected because the judges that presided over the local courts owed their position to popular election, and this made them subservient to the majority of the voters, who happened to be the mine-workers and their friends. Most of the mine-owners had their homes elsewhere, in Utah, California, Colorado, or New York; they did not vote at Goldfield, and they exercised no political influence locally. Moreover, a large proportion of the lessees that hired the workers in the mines were ordinary miners themselves. Their good fortune therefore was not conceded to any superiority of talent or of character. Hence the men they employed thought it only reasonable that they as employees should participate in the luck of those in control of the mining operations. It was a crude kind of socialism.

Further to understand the extraordinary conditions prevailing at Goldfield in 1906 and 1907, it is necessary to refer to the insidious effect of having a stock-exchange close to the mines, and the consequent participation of owners, lessees, and workmen in the wild speculation arising from discoveries of wonderfully rich ore. The leaders of the labor-unions were irresponsible agitators, their personal prestige depended upon stirring up strife between the employers and the employees; their opportunity to make money hinged largely upon the fluctuation in share prices caused by labor disturbances and the settlement of them. During the strike that was ended in April of 1907 the stock market was 'worked' by the officials of the labor-union. They would call a meeting under pretext of settling the strike, and the announcement of this intention would lead to a free buying of shares by the general public; the labor leaders would then sell short, meanwhile covering their shorts by open purchases made through their wives; this stimulated more buying; then the counting of the votes at the meeting of the union would be delayed purposely so as to give the time necessary to complete the stock transactions. Thus they seesawed the market three or four times. It was an impudent game of depredation. Never was there a more vivid example of the undermining of decency by the greed for wealth; only a few men kept their heads amid this scramble for gold; the community as a whole went crazy, and threw aside all the scruples of business morality, and even the conventions of financial rascality.

Thus at every turn the conclusion is reached that the exploitation of ore of unusual richness in a community fundamentally lawless is subversive of the integrity alike of the man that digs the ore, the lessee for whom the miners work, and the lessor to whom the mining property belongs. All of them tried to get more than was due to them; and when they had finished the scramble for their share of the loot, the railroad and the smelter levied a toll that was tantamount to highway robbery. There was not much to choose between them all; it was a case of catch as catch can, with the odds in favor of the man that first placed his hands on the ore—the miner himself.

Diamonds, as one might readily suppose, are easily subject to theft. At Kimberley, in South Africa, there was much trouble on this account, until proper measures were taken to prevent it. During the early days, a large part of the output was stolen. "The sharpest oversight could scarcely prevent nimble-fingered workers from slyly secreting tiny crystals in picking over the concentrates on the sorting tables or in handling the deposit in the rockers and puddling pans." So says the general manager of the De Beers Consolidated.[5] In a single

[5] Gardner F. Williams, "The Diamond Mines of South Africa," Vol. I, p. 264; 1906.

year the mine-owners lost as much as £725,000 by theft. Dr. Hans Sauer says that "at least three million pounds worth of diamonds were stolen every year by the employees, and sold by them to the illicit diamond buyers".[6] An effort was made to stop the stealing by a law known as the Diamond Trade Act of 1880, whereby it became a criminal offense to buy or barter diamonds by anybody except those duly licensed to do so. A special police force was organized to detect and punish offenders. The full penalty was 25 years of penal servitude. Every parcel of diamonds taken from the mines had to be described and registered, with complete data covering every transfer of the consignment from the date of production until final shipment was made of the stones from the Cape Colony.

When the blue ground was exposed to the air and sun, it crumbled and the diamonds were released, to become visible to the pickers, who were Negroid natives. These were under close supervision, of course, but it was impossible to watch everybody all the time. The diamonds were secreted in various places, in the mouth, ear, or nose, or elsewhere, and they were even swallowed. Eventually, before the I. D. B. (illicit diamond buyers) Act was put into force, the De Beers company found it best to buy the diamonds taken by the natives off the 'floors'.

Somewhat later Cecil Rhodes caused compounds to be built for the natives and they had to remain there during their term of service, so that they could not get in touch with any buyer of stolen gems. They were watched and searched, and on the eve of their return to their kraals they were given a purgative, lest they had attempted to secrete diamonds by swallowing them.

When I was at Kimberly in 1925 I saw a photograph (in the De Beers office) of the 21 beautiful stones swallowed by a native and recovered in due course after four days. The diamonds weighed 348 carats and were worth £1067, obviously a big fortune for a native, if he could turn them into money—or cattle. The largest stone weighed 45 carats.[7] In one instance a native swallowed a diamond as big as a large chestnut and weighing 152 carats. In another case a native developed symptoms of tetanus and the visiting physician found an ugly wound on his leg. He opened it for treatment and much to his surprise found a rag full of diamonds. The native had made an incision under the shin bone and concealed the diamonds there. By aid of the doctor, the native soon recovered, a wiser, but poorer, man.

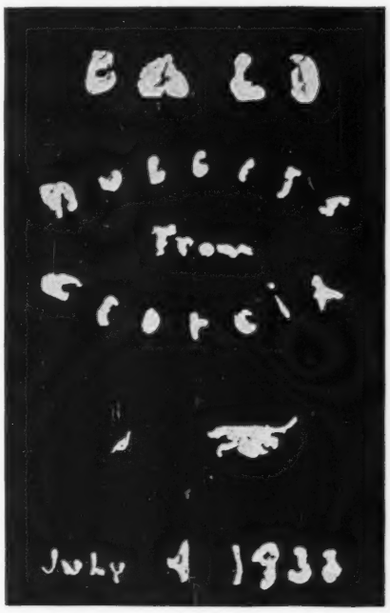
[6] Hans Sauer, "Ex Africa," p. 43; 1937.

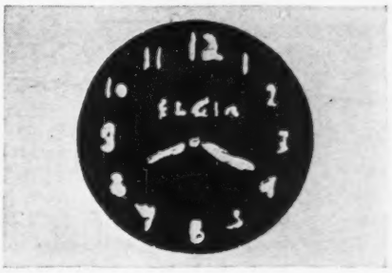
[7] T. A. Rickard, *Engineering and Mining Journal Press*, July 11, 1925.

Curious Gold in "Them Thar Hills"

Oddly shaped nuggets are found in Georgia gravels

ALTHOUGH W. C. Hudson, of Helen, Ga., works Georgia gold gravels with an hydraulic giant, his interest is not confined to mining but extends also to collecting nuggets of odd and unusual shapes, writes Hiram J. Herbert, of Gainesville, in the same State. Nuggets fascinate him. Four years ago he picked one up and noted that it resembled an English setter on point, so he sought one that looked like a quail and in time found it. And there was the picture: the dog pointing the bird. Since then he has found almost every imaginable shape. In his collection are nuggets resembling the letters of the alphabet. With others he has made an almost perfect reproduction of a watch face, with numerals and hands. Still other layouts present various pictures that his fancy has suggested. Nuggets, he says, are where you find them. The ground he is working at present has yielded many of them. Across the mountain, however, in another gravel bank, he has never found one, although he has washed out many "colors" there.





Each character in these two layouts is a gold nugget in its natural form, without cleaning, polishing or extra fashioning.

▼ ▼ ▼

Impurities in Minerals of Picher District

CERTAIN impurities, such as nickel, copper, cadmium, lead, and zinc, are of great significance in the lead and zinc concentrates produced, and subsequently processed, by the Eagle-Picher Mining & Smelting Company, Picher, Okla., according to F. B. Barrett, chief chemist. Because of this, a study was made of certain specimens of hand-picked minerals to determine what impurities they would contribute to the lead and zinc concentrates produced.

Great care was taken in selecting the mineral crystals which were to be analyzed. In addition to visual and microscopic examination to check each for possible inclusion of other minerals, the minerals were leached and washed. Exceptional care was also taken in the laboratory analyses. In many cases, several different analytical methods were used. Blank determinations were also made on the reagents by running a blank sample in parallel with the mineral. The analytical results are presented in the accompanying table, and the reader should pay particular attention to the figures, as each digit used is significant as showing accuracy limits or probable error. For example, .0 per cent means there is probably nothing present unless it be in spectroscopic amounts, but the method and the analyst *guarantee* only that there is less than .1 per cent present. Where .000 is used, it indicates there is probably none present but *guarantees* amounts less than .001 per cent.

Impurities in Very Pure Tri-State Minerals

	Ag, Oz./ton	*Ni %*	*Cu %*	*Fe %*	*Cd %*	*Pb %*	*Zn %*
Galena	.1 (a)	.000	.006	.003	.00	•	.000
Marcasite	.3–.5	.06–.09	.03	•	X	X	X
Chalcopyrite	.15	.001	•	•	X	X	X
Sphalerite	.0	.000	.015–.08	.07–.2	.25–.5	.02	•

(a) The value is plus or minus .025 oz. per ton.
• Not determined.
X Qualitative tests show absence—not deemed advisable to run extremely careful quantitative tests for these impurities.

The Colored Slates of Vermont and New York

II—Structural details and characteristics of the various formations have their economic significance; of the material quarried, 80 to 85 per cent is wasted.. Preparation of products for market.. Prices

David M. Larrabee
Geologist
Poultney, Vt.

IN THE December issue the various slates and accompanying formations of the Vermont-New York area, centering at Poultney, were described, in the order of their occurrence in the stratigraphic column. The article is now brought to its conclusion, this installment discussing the structural details of the slate formations and their significance as to the ability of the local industry to market its products—The Editor.

Structural Details: Bedding—Bedding planes in slates are locally marked by coarser layers, beds of quartzite, changes in color, small lenses of different colored material, and the presence of quartzite nodules. There is usually little difficulty in determining the bed in a quarry, although many small outcrops, mostly covered with glacial drift, offer no sign whatever of the bedding planes. In such formations only the cleavage can be measured. The angle made by intersection of bedding and cleavage determines to a large degree the size of slate blocks of uniform character which can be removed from a quarry. As the beds approach the axial plane of a fold, the dip changes, and the angle between bedding and cleavage increases, reaching a maximum of 90 deg. as the axial plane is crossed. In the neighborhood of this plane, then, the slate will be broken into blocks tending to have a banded cleavage surface.

Where bedding planes characterized by coarser material are crossed by the cleavage, the latter is uneven, tending to spoil the rock for purposes where smooth natural cleavage is desirable. Beds of calcareous quartzite containing siderite and those containing marcasite and pyrite nodules are stained brown; these stained layers produce a banded effect where the cleavage face intersects the bed, thus lowering the value of the slate. In some of the purple and red slates, a ribboned appearance is produced by the narrow greenish bands. These beds have either a calcareous or quartzitic center or a combination of both—the green color extending an inch or so on each side of the central layer. The green changes sharply to purple or red in some, whereas in others the change is gradual. These banded slates are well shown at the Sheldon red quarry, Middle Granville.

Bedding is locally minutely folded or plicated; this is true particularly in the eastern part of the area, where the Mettawee slates become phyllitic. Many of the slates and shales other than colored roofing slates, and argillites, show plicated bedding throughout the region. Thin quartzites in red slate are commonly minutely folded in a series of zigzags appearing like corkscrews in cross-section.

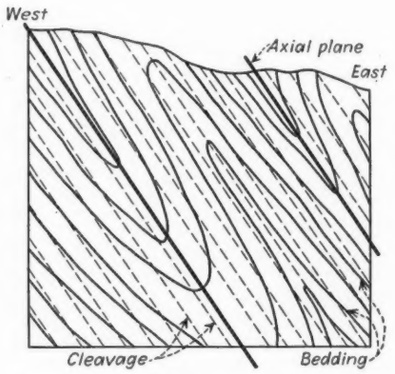


Fig. 14 . . . Relation of flow cleavage to bedding, as used to determine structure

Flow Cleavage—Flow cleavage, or slaty cleavage, permits splitting into thin sheets or slabs, usually at some angle to the bedding. It is produced by the formation of minute flakes of metamorphic minerals such as mica and chlorite and the alignment of these flakes with their intermediate axes parallel to the axis of the fold and extending horizontally, their axis of greatest length parallel to the axial planes of the fold but in a perpendicular direction, and their shortest axes normal to the axial plane.

Cleavage is sharpest in the fine-grained rocks, and most uniform in rocks of unvarying texture. A well-developed cleavage is characterized by small scales of slate which can be brushed off with the hand from a freshly cleaved stone. It has no necessary relation to bedding, although in this area the angle between bedding and cleavage is usually small, and the two are locally parallel on the limbs of the folds. Where the bedding and cleavage are parallel, the blocks of slate having uniform color and texture will be larger than those taken from the part of a fold where the bed and cleavage are not parallel. It is chiefly for this reason that a quarry located on the limb of a fold ordinarily has much less waste than one located near the apex of the structure. A good example of the great waste in a quarry developed on the apex of a fold is seen at Cedar Point, on Lake Bomoseen. Here a quarry was opened in purple slate on the axial plane of an overturned syncline. The rock is badly broken, and the blocks that are of uniform texture and color are small.

Cleavage is locally deflected by a hard bed of slate or quartzite; if the relation of bed to cleavage in this case is carefully studied before the block is split, these deflections can usually be predicted. Where the cleavage crosses beds containing quartzitic nodules, however, no prediction can ordinarily be made, because of the irregularity of nodule distribution.

In general, the cleavage tends to parallel the axial plane of the fold, but slight variations from it are not uncommon. Furthermore, the axial planes of some folds are themselves apparently curved, with a resultant deflection of the cleavage planes.

Cleavage is best developed in the sea-green slates and poorest in the red, which have a coarser texture and

Fig. 15. . . Gash fractures filled with calcite in red slate at the Staso quarry, one mile south of Hampton, N. Y.

higher silica content. Purple and variegated ordinarily have a slightly poorer cleavage than sea-green, but better than unfading green, in which the cleavage is better than in the red.

The relation of bedding to cleavage is important in determining tops from bottoms of beds in this area, where practically all folds are overturned to the west. If the cleavage is steeper than the bed in any particular outcrop, the attitude of the bed at that point is normal—that is, the top of the bed faces upward; if, however, the bed dips more steeply than the cleavage, the outcrop is located on the overturned part of the fold, and the top of the bed is therefore facing downward. The structure can thus be worked out (Fig. 14), following which the quarry operators can make more accurate predictions as to the type of rock to be encountered, as well as more accurate interpretations of drill records. Exceptions to this relationship are to be found along the axial plane of a fold, where bed and cleavage may have opposite dips.

Fracture Cleavage and Gash Fractures—Fracture cleavage, "slip cleavage" of the quarrymen, is the property of parting along rather closely spaced parallel fractures, and differs considerably from flow cleavage in nature. It is developed by shearing of beds, and, unlike flow cleavage, is local in folds. The planes tend to converge downward beneath anticlines and to converge upward above synclines in the folds of this area. This, as well as flow cleavage, can be used in the determination of tops and bottoms of beds. Gash fractures break the slate into small blocks wherever present over closely spaced intervals (Fig. 15). These cracks or gashes are more closely spaced and more strongly developed in quartzites (Fig. 16).

More than one type of fracturing is present in the area. Some gash fractures are rather widely spaced, as in the Staso red slate quarry, whereas fracture cleavage planes are extremely close together, as shown in many of the Scotch Hill quarries, where it is particularly well developed in the slates a short distance south of Glen Lake. In these quarries the fracture cleavage is apparent as minute undulations and slips upon the flow cleavage planes, to which it is usually developed at right angles, the plane of fracture dipping west at 90 deg. to the eastward-dipping flow cleavage. It must, by nature, cause weakness in the slate, but whether this is of much practical importance where the "slips" are minute is not known positively to me, although I strongly suspect the slate so affected to be materially weakened. It is not known whether this minute "slip cleavage" was caused at the time of major deformation or during some later movement.

Gash fractures are extremely well developed in the Bomoseen grit, as shown in the photograph (Fig. 17). In this case the fracture planes are filled with carbonate, presumably calcite and siderite, which upon weathering were removed to leave only a limonite stain. In this specimen the gash fractures form an angle of 50 deg. with the flow cleavage.

Dragfolds—Dragfolds are small folds developed upon larger ones, and are formed by unequal movements of beds in contact. As one bed slips along another, the one moved less is pulled upward, or "dragged." Such small folds are common in formations of all ages throughout the slate belt, and complicate geological mapping. Fig. 18 shows a faulted bed of quartzite on the apex of a dragfold in Bomoseen grit.

In this area, the axial planes of these dragfolds frequently parallel fracture cleavage, and appear to converge beneath the major anticlines. The relative movement of beds is indicated by the direction of drag, and since the upper bed moves a relatively greater distance than the bed upon which it lies, the dragfolds produced can be used in determining tops from bottoms of beds (Fig. 19). This is generally true where the dragfolds are on the limbs of the major structures, but as the axial plane of any tight fold is approached, the degree of accuracy with which these minor folds can be used is markedly lowered, reaching a minimum on the crests and in the troughs of anticlines and synclines respectively. Here the dragfolds are useless in almost every case. These folds appear to be most common in the eastern part of the map-area, where all the folds are tightly compressed and whose axial planes are dipping slightly eastward.

Shear Zones—Shear zones are referred to by local quarrymen as "hogbacks" and "posts." These are zones of weakness in the slate, breaking it into small fragments over a width varying from 1 in. to 2 ft. (Fig. 20). They vary in direction or strike, as well as in dip, but the most common system of shears appears to trend north-to-northeast and to dip nearly vertically. The predominate shears in the Scotch Hill area trend a few degrees east of north. Other sets at right angles to these are not uncommon, and occasionally a diagonal shear has been observed, as for example in the north wall of the Allen quarry, one and one-half miles southwest of Blissville. Vertical displacement of a few inches is common along these zones. In general, the trend of shear zones in any particular district within the area is uniform, and tends to parallel the axes of the major folds.

The larger shear zones are usually filled with irregular masses and anastomosing veins of quartz, adding to the damage to slate in these particular narrow belts. These zones commonly form the butt, or eastern wall, of a quarry, for the expense of quarrying through the masses of vein quartz and shattered slate would be too great to make slate production profitable.

Fig. 16. . . Relations of bedding to flow cleavages, and fracture cleavage in quartzite to jointing in slate. *A*—quartzite with fracture cleavage, *B*—flow cleavage in slate: *C*—jointing in slate

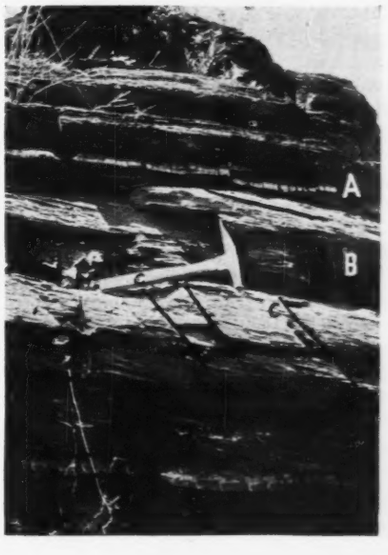


Fig. 17. . . Gash fractures in slaty part of Bomoseen grit. Gashes make angle of 50 deg. with flow cleavage. *A*—gash; *B*—flow cleavage face

Fig. 18. . . Faulted quartzite bed in slaty Bomoseen grit. The more brittle quartzite has broken on the apex of the fold and now shows horizontal displacement

Slickensides are striations on the sides of a break in the rock along which movement has taken place. They are fine grooves and scratches, highly polished, and are commonly coated with green chlorite. These features have been observed on rock faces of faults, diagonal joint systems or "slants," and on bedding planes in some quarries. They are most common in shear zones.

Joints — Joints are well-developed breaks or partings in the slate and other types of rock in the area. They are ordinarily divided into three classes —strike, dip, and diagonal joints. The first two types mentioned are most prevalent in this area. Bearings were taken on only 108 joints, and these were distributed as follows: 64 had trends varying from north to east-northeast, and 44 had trends from east to south-southeast.

Diagonal joints are commonly referred to as "slants" and "slips" by the quarrymen, and movement along many of these joints is indicated by slickensiding. Sometimes they are used as a breaking face in opening a quarry. Usually, however, pits are carried down the dip on the cleave until a strong north-south shear zone or joint is reached. Strong dip joints practically always make the north and south faces of a quarry, for they make clean walls, from which the slate is easily removed.

Joints in the vicinity of dikes tend to parallel the dike walls, but strong sets at right angles thereto are also common.

Faults—Displacements of slate beds have occurred along faults in the Hampton syncline, and between this syncline and the Rising and Nelson quarry to the east. The fault planes vary in trend from northeast to east-northeast, and the horizontal displacement of slate beds apparently ranges from 1,000 to 2,500 ft. in the Hampton structure. Because of composite folding, however, the exact amount of displacement could not be determined. The actual fault planes are not exposed; their presence is inferred from the sharp displacement of beds over such short distances laterally as to preclude the possibility of folding having accounted for the displacement. The major overthrust fault along the western margin of the slate belt has already been discussed.

Grain—Grain of the slate shows as an obscure striation upon the flow cleavage face, and is a structure developed at right angles to this in a vertical plane. Grain is apparently caused by the alignment of the platy minerals formed during metamorphism; the longest axes of the crystals are aligned in a direction normal to the strike of the flow cleavage, and the intermediate axes parallel to the strike of the flow cleavage (Fig. 21). It is a very fine plane of weakness in the slate, and is utilized in breaking the rock across the plane of flow cleavage. Roofing slates, for example, are cut with the long side parallel to the grain, and without proper use of it, large blocks of slate would be ruined during the cutting and splitting processes. Anyone other than an experienced slate worker has difficulty in determining the direction of grain in a slate block.

Economic Geology—Demand, color, hardness, cleavage and scarcity, along with accessibility, sales, and quarry organization, determine the value of slate. In general, red brings a much higher price than any other color, largely because it is least common. It is the most difficult to mill, owing to its hardness and poor cleavage, and this factor also affects the selling price. Unfading green and unfading purple, also hard to work and not present in large quantities, bring a price much lower than red, but slightly higher than the variegated, grays, and sea-green. The last-named has the lowest price because of its easy cleavage, weathering properties, and relative abundance. Many small pits, operated by one or two men, are located in the sea-green slate. Cost of production is slight in such operations; competition is keen and rumors of price-slashing are numerous. However, where an antique roof is desired, the sea-green is most desirable. Hardness is very important where the slate is put to such uses as stair treads and flooring, and for these purposes unfading green is reputed to be in greatest demand.

There are two general types of uses for slate—roofing and structural. In addition to the use of thin slate slabs for roofing—the most common use—the rock of inferior cleavage is ground to a variety of sizes, artifically colored, and applied to composition boards

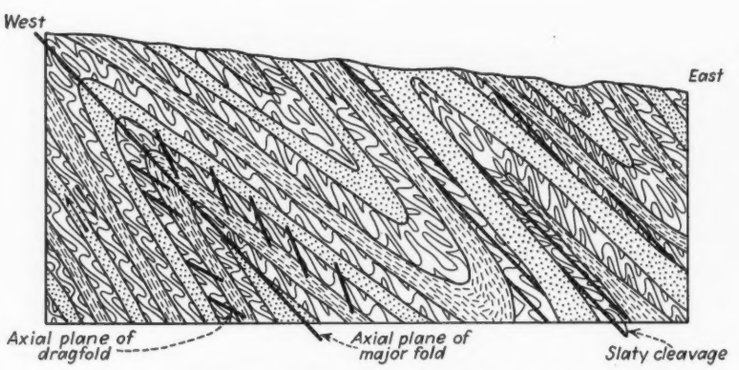


Fig. 19. . . Relation of drag folds to major folds in the slate belt. Axes of drag folds tend to converge beneath anticlines, and to form fracture cleavage

and paper, which are then used for roofing purposes. At present, the greatest activity in this area as far as the quarrying of high-grade unfading green and purple roofing slate is concerned is in the north central part, a mile southwest of Blissville, although South Poultney quarries are active.

Structural uses for slate include stair treads and risers, platforms, base, border, wainscoting, partitions, chimney caps, urinal stalls, bowl slabs, tanks, shower stalls, water-closet stalls, thresholds, saddles, window sills, flagging, billiard tables, hearths, mantles, blackboards, tiles, sinks, table tops, switchboards, and burial vaults. There has been a recent demand for marbleized slate, as well as for game boards made of colored slate tile. Slate used for these purposes is called "mill stock," and is frequently rock of inferior cleavage, although not necessarily so. It is ordinarily harder, of coarser grain, and poorer cleavage than that used for roofing purposes. The slate producers have constantly been on the lookout for new uses of their products, and during the last five years many have been developed. This was necessary because of the decline in general construction and the development of substitutes.

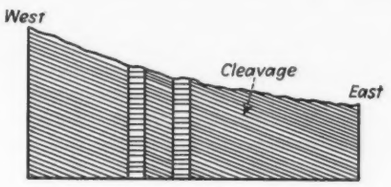


Fig. 20. . . Shear zones or "hogbacks" in slate

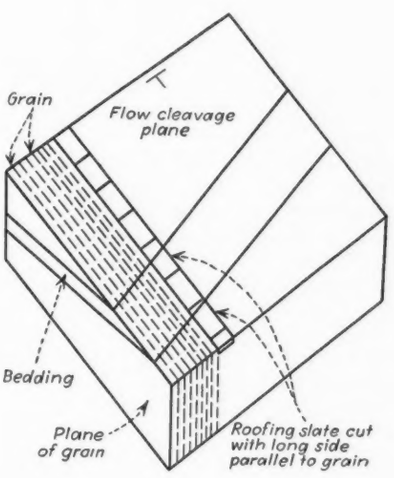


Fig. 21. . . Diagram showing relation of grain to flow cleavage

The value of any particular quarry is not decided by color and hardness alone; strength and spacing of joints, presence or absence of shear zones and fracture cleavage, amount of top rock and glacial till necessary to be removed, and related factors, as well as proximity to transportation routes, are of great importance.

Some producers prefer, where possible, to locate quarries on the lowlands and in recently drained areas where the weathering processes have not penetrated to great depth. Water, as long as it does not alternately freeze and thaw many times, protects the cleavage, and it is chiefly for this reason that good quarries not being worked during the winter months are flooded. Cleavage of the slate below the frozen surface is not impaired.

Waste is great in the slate industry, averaging from 80 to 85 per cent. From this can readily be seen just what the producers must contend with, and one reason why slate is expensive. Varying textures and hardness within a quarry, presence of closely spaced joints, shear zones—often filled with irregular masses and veins of quartz; presence of pyrite, beds of hard quartzite, irregular cleavage, gash fractures, and fracture cleavage all make for waste.

Some of this, it is believed, could be eliminated through careful planning and the application of the principles of sedimentary and structural geology. The difference between a bed of quartzite and a quartz vein must be kept in mind by the quarrymen, who commonly class them both as "flints" and have little idea as to their occurrence. The veins are most common in shear zones developed near the axial planes of the folds. In many quarries there appears to be a relation between the presence of these veins and the presence of chlorite-covered slickensides on slate exposed at the surface; thus, where slickensided shears showing movement are present in large numbers at the surface, there is a good possibility of encountering quartz veins below. Such slickensides are themselves indications of slate broken by shear zones and small faults; in general, particular outcrops, where they are present, should be avoided for quarrying purposes.

A quarry usually has less waste if located on the limb of a fold rather than on the apex, as has been previously stated. It is true that the individual beds of slate are thicker where the axial plane is crossed, because of rock flowage, but here the flow cleavage cuts the bedding at right angles, with the result that only small blocks may be obtained, and they are weak because of the fact that differences in texture of beds form planes of possible separation. Tension cracks are usually found on the crests and troughs of folds, and these, too, form planes of weakness. Thus a quarry located on the limb of a fold, where the cleavage is parallel or nearly parallel to the bedding, will ordinarily produce larger blocks of stronger, more uniform slate.

One error on the part of many quarrymen is the location of the dump. In most cases the waste rock has been dumped too close to the quarry opening, with the result that as the pit is enlarged the waste must be rehandled at considerable expense. The dumps frequently have been located where the butt of the quarry was planned; if it was later desirable to extend the working farther eastward, either the waste had to be moved or the project abandoned.

In prospecting for any given color of the Mettawee slates, it should be borne in mind that the gray is usually, where present at all, on top of the purple and green, and that purple is commonly, but not always, on top of

Fig. 22. . . Method of hoisting slate from the quarry floors. Butt of pit at left. Photo taken at Allen quarry

Fig. 23. . . Workman cleaving a block of slate into slabs for flagging purposes, at the Allen quarry

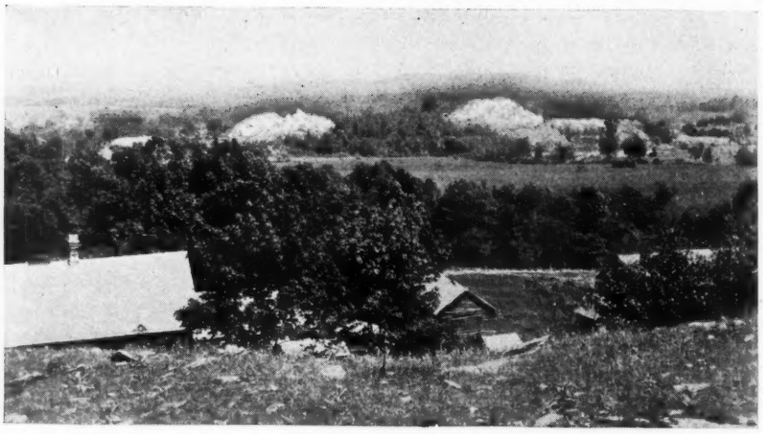


Fig. 24. . . Quarry dumps southwest of Blissville show large heaps of waste rock

green, except where the beds have been overturned. The green and purple colors are interchangeable along the strike of the beds, and do not occur as long, distinct color units. Relation of strike and outcrop of bed to topography must be considered; that is, the fact that the bed will not always be found "on strike," but will vary from it as the surface of the ground rises or falls along the strike. Many quarrymen do not take this into consideration, but expect a certain bed always to appear "on strike."

Plunge of folds should be taken into consideration when locating a quarry. Major folds in the slate belt ordinarily plunge southward; consequently it would generally be unwise to attempt northward development of a quarry located on the north end of a fold, for in most such cases the slate which was originally present has been removed by erosion, and therefore cannot be found at depth.

Prospecting for Normanskill red slates should be confined to the areas where the Normanskill banded graywackes, quartzites, and cherts occur, as the red slate is present only in this formation. Since this slate occurs in lenses of greatly varying size, and because these lenses grade along the strike into similarly shaped masses of other rocks, prospecting is rather haphazard at best. Red slate interbedded with layers of red chert has a poor cleavage and is usually excessively hard; it is also thin-bedded in these particular districts.

In general, the Mettawee slates some distance from the Taconic Mountains are of finer texture and of sharper cleavage than those near the mountains, where the slates are more quartzitic and phyllitic. From the distribution of unfading green occurrences, it would appear that prospecting for this slate should largely be confined to the region between Lake Bomoseen on the north and Poultney, Vt., on the south.

Milling—After drilling and blasting in the pit, the blocks are hoisted to the surface (Fig. 22). They are then conveyed by cable to the edge of the pit, where they are split for roofing or are loaded on trucks for hauling to the mill. Practically all roofing slate is cut, split, trimmed, and punched at the quarry, where it is stacked by color and sizes. The slate can be cleaved to any desired thickness, the standard thicknesses being $\frac{1}{4}$ in., $\frac{3}{8}$ in., and 1 in. Blocks are cleaved by hand, the operator using a wide hard chisel and small sledge hammer, as shown in the photograph (Fig. 23). Fig. 24 shows the large dumps of waste slate at the quarries.

The slate to be used for structural purposes, after reaching the mill, is usually first plugged and split on the grain, sawed, and then split to proper thickness, after which it is planed and trimmed. If a sand-rubbed flat surface is desired, the slab is then placed on a horizontally rotating steel rubbing bed, where sand in water is the polishing agent. If a very fine finish is needed, the slate is honed down by hand. Should smooth edges be desired, the slab is cut by a thin carborundum saw, rotating at high speed, which saws and polishes in one operation. Special effects, such as beveling, rounding, and hammered and frosted edges are available if wanted.

If the slate is to be used for roofing granules or for surfacing driveways and tennis courts, the material is sorted at the quarry, and then taken to the mill, where it is ground and the resulting granules are separated from the material unfit for use. The Staso Milling Company operates a large mill and quarry in green slate at Castleton, Vt., where slate granules are made in large quantity and in great variety of sizes and artificial colors. Some natural colors are used, however. Their quarry in red slate is situated south of Hampton. The fact that a dike badly shatters the slate at this quarry is of little consequence, for large blocks of strong slate are not required.

Slate prices, quite high before the depression of 1929, reached a level so low in the six following years that only a few well-established slate companies were able to operate successfully. During this time, many producers were forced out of business, quarries were closed, and mill equipment was permitted to go to ruin. In 1935, general building construction increased, chiefly through PWA grants, and prices, already on an upward trend, made it possible for the producers still in business to begin to show profit. Business picked up rapidly during and after the summer of 1936, but decreased at the end of 1937.

Sea-green roofing slate is at present being sold to roofing contractors for $7 per square (enough slate to cover 100 sq.ft. of roof), including punched nail holes, f.o.b. quarry. Unfading slates are being sold for $10 per square. Red roofing slate is much higher, averaging about $25 per square of standard 3/16-in. slate in 16- to 24-in. lengths.

Structural slate prices depend upon the color, finish, and size of slabs. The average selling price for small slabs in sand-rubbed finish, 1 in. thick, is $0.42 per square foot, not crated, at the mill. The average price of rough unfinished blocks, 1 in. thick, at the quarry is approximately $0.20 per square foot. A honed face usually costs $0.11 per square foot extra. The price of structural slate increases with thickness. Practically all finished and sawed slate is made from the unfading colors—unfading green, purple, variegated, and red.

In 1938[9] the quantity of slate produced for all uses in the United States increased 10.8 per cent from that produced in 1937, and the value increased 0.9 per cent over the same period. Roofing slate decreased in 1938. Vermont had the largest number of producers for 1938, with 51 companies or individuals operating. Pennsylvania was second with 31, and New York third with 17. The output of roofing slate in Vermont was 83,490 squares, valued at $577,279, compared with 102,110 squares, at $782,686, in 1937. New York produced 2,780 squares, valued at $26,340. Pennsylvania led in production, with 195,560 squares, at $1,293,426.

The value of 135,750 sq.ft. of Vermont mill stock was $68,279, and that of slate used for other purposes, such as flagging, granules, flour, etc., was $1,084,097. Value of New York slate for these last purposes was $418,991. The total value of slate produced in Vermont was $1,729,655, and in New York, $445,331. Sales of roofing slate in Vermont and New York decreased 20 per cent in quantity and 28 per cent in value. The total value of all sales gained 21 per cent compared with 1937, this increase being due chiefly to granule sales.

Acknowledgments—Active coopera-

[9] Minerals Yearbook preprint 1939, pp. 2–5.

tion and guidance in this work were given me by H. M. Bannerman, of Dartmouth College, and T. T. Quirke, of the University of Illinois. I am also grateful to E. S. Carpenter, of the Vermont Slate Flooring Corporation, Poultney, and to Jack A. Larrabee, for field assistance. Many quarrymen in the district assisted in various ways. Dr. R. Ruedemann kindly examined specimens of the Normanskill colored cherts. Frequent references have been made to the previous work of Dale, particularly in view of the fact that no attempt has been made to duplicate the petrographic and mineralogic studies embodied in his report. I hope that the material presented will be of direct use to the slate producers of the region, as well as of general interest.

Many have contributed to the geological knowledge of this slate belt, but T. N. Dale[10] has enumerated those who had made the greatest contribution up to 1895. Prior to that date, work in this general region was done by Ebenezer Emmons and William W. Mather, C. H. Hitchcock, Hager, Logan, and Hall. C. D. Wolcott published a map of the Taconic region in 1888. In 1894, W J McGee compiled a geological map of New York State which included a part of this area.

In 1897-98 Dale[10] described in detail the structure and economic aspects of the problem and I have made frequent reference to his good work. Cushing and Ruedemann, in their report upon the geology of Saratoga Springs and vicinity, published by the New York State Museum in 1914, dealt with some of the formations of the slate belt. Prindle and Knopf worked with some of these in the Taconic quadrangle prior to 1932, and Ruedemann and Wilson made a special study of the colored cherts occurring with the Ordovician red slates in 1935-36. Arthur Keith, in the course of his studies in the Lake Champlain and related regions to the south, mapped faults and formations in the northern part of the slate belt.

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[10] Dale, T. N.: "The Slate Belt of Eastern New York and Western Vermont." U.S.G.S. 19th Annual Report, 1897–98, Part 3, p. 165.

Placering Has Its Pitfalls!

The inexperience of new investors is often great

Merle H. Guise
Seattle, Wash.

WHENEVER I hear the words "eminent engineer," I cannot but recall with sorrow a placer property that I had prospected and developed to the point of turning it over to one of the so-called "big outfits," and they engaged an eminent base-metal geologist to pass upon it! It is doubtful if he had ever before examined a placer property, and he did not even set foot upon this one, but called in an old, arbitrary underground hard-rock driller who insisted upon drilling, although shafts were plainly indicated on the ground. The net result was that valuable time was wasted, ruining the proposition, much money was spent in drilling, and I left the picture by paying the unpaid bills of the hard-rock driller for work which I had begged the eminent geologist not to do.

Boston interests once asked me to examine a hydraulic property in Montana. In going over it on the first day with the one in charge, I called attention to an earth dam, obviously not built for storage. The manager stated he had put it in as "a dam is necessary in hydraulic work," and as he had to raise the water level of the creek up to the ditch line built at the same time. A glance up the creek indicated a grade of 10 per cent, and the plain fact that a couple of hundred feet of pipe could have been set to tap the creek a few feet up, at an expense of about $400, as against a much larger sum spent upon the dam. Creek and dam both were dry. That first day was the last for me, because it was likely that no water would be available. Rights or leases entered into a lifetime before, although approved by the eminent legal department in the East, had become ineffective, since the local communities were now consuming all the water previously available.

A visit to a large placer project, upon which more than $50,000 already had been disbursed, revealed that half of this sum had been spent on "surveying" the ground, with a production of 3 oz. of gold to date. Just why so much surveying, I did not know until I went over the ground with the manager—a former land surveyor! When questioned, he explained that this eliminated the need of the usual expensive prospecting. He had run contours and plotted the area according to elevations! On a huge map some circular spots were outlined in vertical stripes—larger areas surrounding in diagonal hatching, and anything up to 10 ft. elevation (the vast area of swamps) in horizontal lines. The horizontal lines would be dredged; the diagonal lines hydraulicked; and the vertical-lined knolls draglined—in that order of operations! Asked why he considered the swamp dredgeable, he replied that gold sought the lower levels! Why consider hydraulicking on the hillsides?

A quick look indicated there was no gravel near by (nor anywhere in the area)—it was 100 per cent clay. It could not be hydraulicked because there was no gravity water available, power costs would have been too high for pumping against clay, and a little panning indicated much less than $2.50 per yard and a smaller yardage than the beautiful report claimed; and the knolls could not be draglined because they were clay, and short of both values and yardage.

The surveyor really was frank in admitting his inexperience in placering and indicated a willingness to be taught. So we settled down and in a week or so had figured a way of working the slopes. The property was nevertheless not one to justify the purchase of the large machinery that had been ordered.

The usual procedure of those newly initiated into gold placering, where more capital than experience is available, seems to be to reverse the order that practical operating companies follow—first, the machinery is ordered and installed; second, they wonder what is in the ground; and third, they get some one (practical or impractical) to start prospecting.

Placer gold prospecting, or engineering, or mining, is just as highly specialized as metallurgy, or underground timbering, limestone quarrying, or other jobs, though part of the big job of mining. Because they think there is nothing more to placer mining than "crowding the gravel through," is the reason that some of the dirt movers or contractors with a spare dragline, fail to obtain satisfactory results in gold mining, or at least mess around until they have discovered the difference—gaining experience the expensive way.

As much money is sunk into gold mining, it is said, as is taken out in dividends. But it is remarkable that it is no worse when one considers the ill-advised ventures exploited by new companies and sometimes interests well established in other lines of mining.

USEFUL OPERATING IDEAS

Handy Carrier For Detachable Bits

JACK HOWARD, of the Mission Mining & Development Company, at Baxter Springs, Kan., has designed a handy detachable bit carrier made from heavy rubber belting, according to W. F. Netzeband, of the Tri-State Zinc & Lead Ore Producers Association. The carrier shown in the photograph is made of belting 13x16 in. in size and carries five rows of four bits. Its threaded studs are fastened to the belting with $\frac{3}{8}$-in. plough bolts, the studs being countersunk to receive the bolt head. The handle is fastened on with 5/16-in. elevator bolts.

This carrier enables the machine men to find the correct bit without difficulty, and as the worn bit can be screwed in place as the new bit is removed, there should be no excuse for bits being lost in the muck.

A variation of this carrier is in use at the See Sah mine of the Eagle-Picher Mining & Smelting Company. A discarded screen jacket of about the

same size as the carrier described in the foregoing has studs riveted to both sides, using twenty-penny nails for rivets. This permits a larger number of bits to be kept at the working face.

▼ ▼ ▼

Speeds Thickening Capacity Tests

ONE of the most tedious and time-consuming calculations concerned in routine ore-testing practice is that of thickening tests, writes Fred C. Bond, 1645 South 80th St., West Allis, Wis. In the usual method, a weighed sample of the ground ore is placed in a 1,000-cc. graduated cylinder, agitated with the solution, and readings of the settled pulp level are taken at intervals of one minute or several minutes. The dilution of the pulp, which is the number of parts of liquid to one part of solids by weight, is calculated from the readings on the graduate and the specific gravity of the ore, and the ultimate dilution is found by allowing the sample to stand until no further settling takes place.

If F represents the dilution at each of these readings, D the dilution of the thickener discharge, R the settling rate of the solids in feet per hour, and A the required thickener area in square feet per ton of settled solids per 24 hours, it can be shown that

$$A = \frac{4\ (F-D)}{3\ R}$$

A is calculated from this formula for each of the graduate readings taken, and the maximum value is selected as the required thickener area.

The calculations may be greatly simplified, and performed in a fraction of the time formerly necessary, if the following method is used:

A strip of celluloid 16 in. long and 1 in. wide is graduated into six divisions of $2\frac{2}{3}$ in. each, and each division is divided into tenths. These can be conveniently scratched on the celluloid with a sharp point.

The scale is laid on the graduations of the 1,000-cc. cylinder, and the value of $2\frac{2}{3}$ in., or one scale division, is found in cubic centimeters. We will designate this value as G; it is ordinarily about 195 cc. It is equal to the weight in grams of the dry sample of ore taken for each test, when this particular graduate is used.

G grams of the dry ore, ground to the desired fineness, is placed in the 1,000-cc. graduated cylinder, and the celluloid is placed on the outside of the cylinder and attached with rubber bands. G is divided by the specific gravity of the ore, to determine the number of cubic centimeters occupied by the dry solids, and the zero point, or lower end of the scale, is placed at this number of cubic centimeters as graduated on the cylinder. It will ordinarily be about 75 cc. above the cylinder bottom. Dilution of the pulp at any stage of settling can now be read directly as scale divisions.

The solution in which the thickening is to be done is added to the cylinder. The exact amount of solution added is unimportant, but to test the greatest range of dilution possible it should extend up beyond division five. It is blunged, or churned, with a large cork fastened to the end of a stiff wire, and allowed to stand in contact with the ore for several hours.

After standing, the pulp is thoroughly blunged, and dilution readings (F) of the settled pulp level are taken on the scale at intervals of one minute or two minutes. The scale is read to hundredths of a division, the last place being estimated. The settling rate in scale divisions per minute is tabulated with the time, opposite each dilution reading. Readings are taken at longer intervals as the settling rate subsides, until the ultimate dilution is obtained.

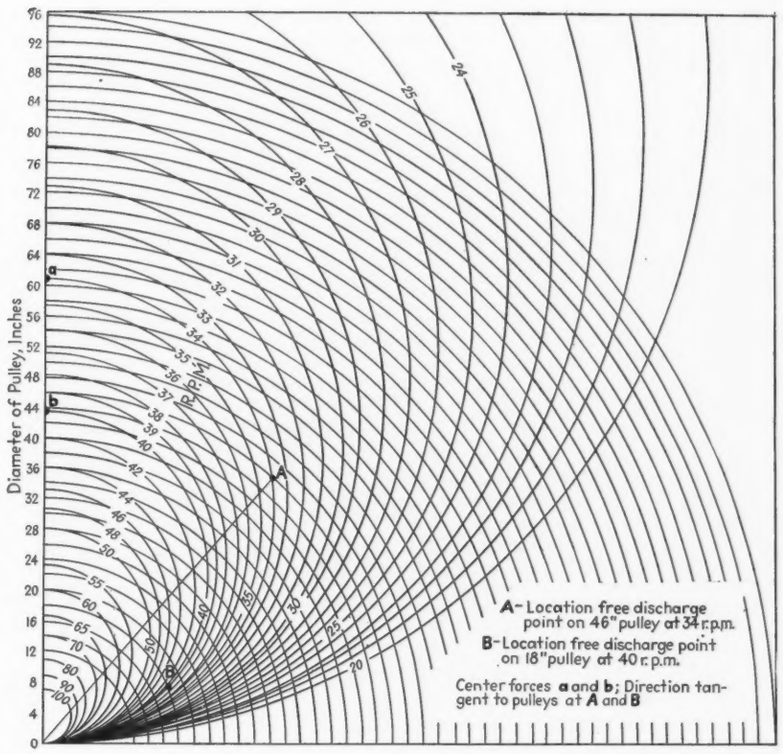
The dilution D of the thickener discharge may be the ultimate dilution obtained, or it may be larger. When D is known, the required thickener area is readily calculated for each value F of the dilution of the thickener feed, by the following formula:

$$A = \frac{F-D}{10\ \text{(Divisions per minute)}}$$

In this equation, A is the thickener area in square feet per avoirdupois ton of solids settled per 24 hours. The largest value of A is selected as the required area for a thickener producing an underflow of dilution D.

The specific gravity of the ore must be determined if it is not already known. This is conveniently done with a 100-cc. weighing bottle, or pycnometer. A sample of the dry ore is poured into the weighed bottle until it is about two-thirds full, and the bottle and ore are weighed. Ore crushed to about minus 6 mesh is the most suitable for this purpose.

Sufficient water is added to cover the ore, and the bottle is shaken vigorously, after which more water is added and the shaking repeated. When treated in this manner, the agitation is sufficiently vigorous to remove nearly all of the adsorbed air from most ores. If it is not completely removed, the bottle can be placed in a beaker of water and the water boiled, or it can be placed under an evacuated bell jar. The bottle is finally filled with water and weighed at room temperature, and the specific gravity of the ore is calculated.


Diameter of Pulley, Inches
A- Location free discharge point on 46" pulley at 34 r.p.m.
B- Location free discharge point on 18" pulley at 40 r.p.m.
Center forces a and b; Direction tangent to pulleys at A and B

Belt Conveyor Discharge Points

DISCHARGE POINTS on belt conveyors are of some interest to designers who have matters of spouts and of head-room under consideration, writes A. O. Gates, of 887 3d Ave., Salt Lake City, Utah.

The accompanying graph was made for this purpose; at the intersection of the line representing the diameter of the discharge pulley decided upon and the curve of the RPM will be found the point at which the combined force of gravity and centrifugal force are in the direction of the tangent to the pulley and thereafter the material is a free agent (at least free of centrifugal force) moving with the velocity of the belt in the direction of the tangent, and under the pull of gravity.

In cases where the curve of RPM comes within the pulley diameter, or just touches it, the material leaves the belt without the benefit of centrifugal force, going in the direction of belt travel, deflected by gravity.

The foregoing is intended for dry material. Where the application is for somewhat sticky material, about all the benefit the designer will glean is that he will know where he can start to put brushes, scrapers, and the like, or that he may use a smaller pulley and give the material more force to take it from the belt.

The surprising thing about this diagram is that it contains practically all the data required about "Critical Speeds" and which I applied to ball-mills, bucket elevators, and some other horizontal shaft machines 25 years ago.

The critical speed for any diameter is the RPM of the curve which cuts the vertical line at the same point as the curve of pulley diameter. About this point the combined forces are radial and proportional to their lengths measured from this point. The actual force at any point may be found by giving the value of the force of gravity to the distance from this critical point to the center of the pulley (bottom of the diagram), or the diameter of the RPM circle, when the force at any point may be measured in terms of gravity by using this distance as the unit.

This curve will give suitable bucket elevator speeds for discharge of all materials especially those which are liable to hang back. Use the diameter made up of that of the head pulley plus twice the distance from the pulley to a point about ½ in. inside of the bucket.

Ball-mills run at about 70 per cent of the critical speed; that is, at 70 per cent of the RPM which would coincide at the inside diameter of the mill. The center of combined forces would be at the upper end of the RPM curve, as before, with actual force at any point as already explained. Seventy per cent of critical speed would put the critical point at just about double the radius of the inside of the mill above its center.

The formula is, N^2R equals 35,000 approximately, or N^2D equals 70,000 approximately, where N is RPM, and R and D are radius and diameter in inches; the derivation comes from the ordinary centrifugal force formula, making centrifugal force equal the force of gravity.

▼ ▼ ▼

Acid Pump Alteration

AT A LEAD SMELTER on the Pacific Coast difficulty was experienced with centrifugal lead pumps handling acid plant products. The units in question were of conventional design, with the impeller screwed directly to the pump shaft and the flanged end of the intake pipe secured to the hard-lead pump body by means of steel studs (Fig. 1). After a relatively short period of operation both the impeller and the studs would become loose, resulting in excessive vibration and leakage at the intake joint and final shutdown.

To provide safer and more continuous operations, the pump design was changed in the manner indicated in the accompanying line cuts. The pump body was provided with a flanged intake end as in Fig. 2, the intake pipe being attached to it by bolts, and the impeller was fitted securely to the pump shaft by a stainless-steel bushing as in Fig. 3.

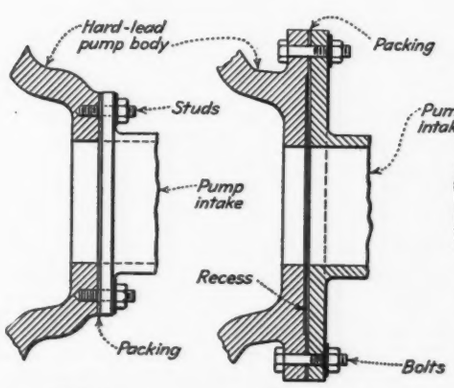


FIG. 1

FIG. 2

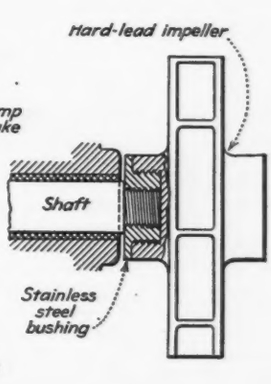


FIG. 3

NEW BOOKS

SCIENCE AND SOCIAL CHANGE. *Compiled by Jesse F. Thornton. Published by The Brookings Institution, Washington, D. C. Pp. 577. Price $3.*

THE compiler has brought together a total of 49 selected readings from the writings or addresses of men who, in the last half century, have given thought to the effects produced, or likely to be produced, upon human society by scientific discovery. More than half of these selections are less than five years old, this proportion indicating the increasing concern of thinking people over the situation. The book, in fine, is a course of reading. It should aid many in clarifying their thinking on the subject.

GRAPHIC PRESENTATION. *By Willard C. Brinton and published by Brinton Associates, 599 Eleventh Ave., New York City. Pages 512 (250 of them in color). Price $5.*

TO ALL who ever have the need, or desire, of presenting facts or figures graphically, this new book of Mr. Brinton's will be of great assistance. It is an unusual volume, with unusual contents, which, in keeping with the title, are presented graphically to a large extent. Throughout, the subject is handled with a minimum of descriptive text. In the 512 pages there are 620 illustrations, many of them full-page reductions of charts, cartoons, and posters. In printing, four colors have been liberally used (on 250 pages) with black, to illustrate the various techniques and to reproduce the originals as closely as possible. From detailed inspection it would seem that every conceivable kind of chart has been presented. In addition, some of the 60 chapters deal with such subjects as the following: the camera and its use, lantern slides, preparation of illustrations, color and its use, methods of printing, selection of paper, binding techniques, displays and exhibits, dioramas, and graphic charts in conference rooms. An "instant" index facilitates the use of the book.

INTERNAL CONSTITUTION OF THE EARTH. (Part VII Physics of the Earth). *Edited by B. Gutenberg. McGraw-Hill Book Company, New York. Pp. 413. Price, $5.*

CONTRIBUTING to this volume, which is one of a series of monographs on the physics of the earth prepared under the direction of various committees of the National Research Council, are L. H. Adams, R. A. Daly, the editor himself, H. Jeffreys, W. D. Lambert, J. B. Macelwane, C. F. Richter, C. E. Van Orstrand, and H. S. Washington, who have divided the sixteen chapters among them. Introduction and a concluding summary are by Gutenberg, who also is responsible for several other chapters.

INTRODUCTION TO MINE SURVEYING. *By W. W. Staley, Stanford University Press, Stanford University, Calif. Pp. 275. Price $3.50.*

ANNOUNCED indeed as "the first American text on mine surveying in 25 years," this little book will be welcome to many a young engineer as well as to the student himself. It is true that there has been a dearth of printed information on the subject, for whatever reason. Curiously, in this connection, the last two years have seen the appearance abroad of two rather ambitious works on elementary surveying, in Polish and Italian respectively. Professor Staley teaches mining at the University of Idaho. His book is based on his own past practical experience in the field and his present classroom work and, in part also, on correspondence with engineers in several countries. He starts with the assumption that the reader knows the theory underlying surveying principles. Thus he emphasizes the practical nature of his book. Among the subjects treated in the fifteen chapters are: determination of the meridian, transferring the meridian, underground traversing, stope surveys, triangulation system for mining property, tunnel surveys, and borehole surveys.

PRINCIPLES OF MINERAL DRESSING. *By A. M. Gaudin. McGraw-Hill Book Company, New York and London. Pp. 554. Price $5.*

DEPARTING from the traditional treatment of this subject, the author had adopted a useful and refreshing presentation. He emphasizes fundamental principles and minimizes machine descriptions, details of practice, and discussion of auxiliary operations. This he deems essential in view of the great changes that have occurred in the art of mineral dressing in the past 30 years. Taking a cue from the field of chemical engineering, where the "unit process" and "unit operation" point of view has long prevailed, the author applies the same treatment to crushing, grinding, screening, classification, flotation, and other complementary operation. Each step is analyzed on the basis of the physical and chemical principles involved. Although the book is written primarily as a text for instruction, it should be useful to operators also who want to understand better the principles of the processes they are working with. The volume is a fitting companion to the same author's "Flotation."

SURVEY OF MINES—1939-40. *The MacLean Publishing Company, Ltd., Montreal and Toronto, Canada. Price $2.*

MORE than 2100 mining companies in the Dominion of Canada and Newfoundland are now actively engaged in producing minerals and developing mineral prospects. These companies are carefully analyzed in *The Financial Post's* annual survey, which is a complete directory of Canadian mines. Data are given on location, property, financial position, production, and management. Companies are grouped by provinces and mining areas, and maps show the relative position of claims and properties in each area. Facts about the mining industry in general are included.

BLAST FURNACE PRACTICE. *By Ralph H. Sweetser. McGraw-Hill Book Company, New York. Pp. 356. Price $4.*

AS FURNACES grow more exacting in their requirements respecting iron-ore preparation, it will interest the ore producer to know more about the metallurgical features of his business, if he is not already informed. The quality of the raw materials affect the furnace product and, as the author says in his foreword, all members of the operating organizations, from the working faces of iron and coal mines to the steel plants and foundries, should understand these effects. The book is a concise description of modern blast-furnace practice. Mr. Sweetser is a well-known authority on the subject.

The chapter headings will give a fair idea as to the contents. They are as follows: I, The Blast Furnace Plant. II, Raw Materials. III, Theory and Chemistry of Blast Furnace Process. IV, Operating the Blast Furnace. V, By-products of the Blast Furnace. VI, The Commercial Side of Blast Furnace Practice.

In short the book, as its announcement states, is a comprehensive manual on all aspects of the production of pig iron, covering as it does plant equipment and raw materials, as well as operating practice, character and utilization of products and byproducts, theories of the process, commercial aspects, and obsolescence. Throughout the operating man's viewpoint is emphasized.

A DESCRIPTIVE PETROGRAPHY OF THE IGNEOUS ROCKS. Vol. I, revised edition. *By Albert Johannsen, University of Chicago Press. Pp. 318. Illustrations 145. Price $4.50.*

IN HIS PREFACE to the first edition of this work in 1931 the author explained that various classifications of rocks in use at the present time, including his own, were impartially pre-

sented for the unbiased choice of the reader. In the eight years intervening between the first and second editions, various modifications have been suggested for a number of the classifications. But the author resists the temptation to introduce endless modifications that tend only to defer systematization. He sees no reason for changing his own classification radically. The various chapters deal with the constituents, structures, and texture of igneous rocks, and numerous systems of classification.

The chapter headings are as follows: I, General Introduction. II, The Constituents of the Igneous Rocks. III, The Structures and Textures of Igneous Rocks. IV, Classification of Igneous Rocks. V, Microscopic or Field Classifications of Igneous Rocks. VI, Chemical Classifications. VII, The System of Osann. VIII, The C.I.P.W. Classification. IX, The System of Hommel. X, The System of Niggli. XI, The System of von Wolff. XII, Qualitative Mineralogical Classifications. XIII, Quantative Mineralogical Classification. XIV, The Quantitative Mineralogical Classification Used in the Book. At the end are appended two glossaries and a list of definitions of rocks with several tables.

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PUBLICATIONS

RECEIVED

Geology and Ore Deposits of the Atlantic District, Elmore County, Idaho. By A. L. Anderson. Pamphlet No. 49. Idaho Bureau of Mines and Geology, Moscow, Idaho. Pp. 71.

Geology of the Anorthosites of the Minnesota Coast of Lake Superior. By Grout and Schwartz. University of Minnesota Press, Minneapolis. A monograph on the high-calcium feldspars of north-east Minnesota. Pp. 119. Plates, 6. Price $3.

British Columbia. Annual Report of Minister of Mines, 1938. Victoria, B. C. Pp. 54. (This report is now issued in seven parts, A to G inclusive. The statistical review of the mining industry is to be found in Part A).

"The Mineral Industry of Alaska in 1938," by Philip S. Smith. Bulletin 917-A, U. S. Geological Survey. For sale by the Superintendent of Documents, Washington, D. C.; price 35c.

"Bibliography of the Geology and Mineral Resources of Arizona," by Eldred D. Wilson. Geological Series No. 13, Bulletin 146, Arizona Bureau of Mines, Tucson, Ariz. Price 35c. (free to residents of Arizona).

"Opportunities for Rock Wool Manufacture in Georgia," by A. S. Furcron, A. C. Munyan, and R. W. Smith. Information Circular 10, Division of Mines, Mining and Geology, State Capitol, Atlanta, Ga.

Mineral Resources of San Diego County. Quarterly chapter of State Mineralogist's Report XXXV, Vol. 35, No. 1, January, 1939, California Journal of Mines and Geology, State Division of Mines, Ferry Building, San Francisco, California.

Geology and Mineral Deposits of Bridge River Mining Camp, British Columbia. By C. E. Cairne, Memoir 213, Geological Survey, Ottawa. Pp. 140 plus maps. Price 50c.

Steam and Hot Water Fitting. By W. T. Walters, American Technical Society, Drexel Ave. at 58th St., Chicago. Pp. 184. Price $2.

Milling Methods 1934. Vol. 134, Transactions of American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York. Volume sponsored by Rocky Mountain Fund. Contains 31 papers (with discussion of 20) presented variously at annual meetings held in New York in 1935, 1936, 1937, 1938, and 1939, and some papers presented at the Tucson meeting in 1938. Pp. 459. Price $5, net.

Metal-Mine Accidents in the United States, 1936. Bulletin 422, Bureau of Mines. For sale by Superintendent of Documents, Washington, D. C., price 10c. Pp. 53.

Electrolytic Manganese Metal from the Ores of the Olympic Peninsula, Washington. By R. W. Schatz, Bulletin W. Mining Experiment Station, State College of Washington, Pullman, Wash. Price 20c.

Map of California Quicksilver Deposits. This measures 37x42 in. and is a half-scale reduction of the colored Geologic Map of California published recently. By means of red spots, the locations of individual deposits are indicated. Published by the California State Bureau of Mines, Ferry Building, San Francisco, Calif. Price 50c.

Annuaire Statistique Hongrois, 1937. Edited and published by the Central Royal Hungarian Statistical Office, Budapest. Pp. 436. Price, 6 pengös.

Federated Malay States. Annual report on social and economic progress for 1938. By H. Fraser, Acting Federal Secretary. Contains 6 pages on commercially important minerals. Published at Kuala Lumpur, F.M.S., by Government Printer. Pp. 129. Price 2s. 4d.

Tanganyika Geology. "Outline of the Geology of the Uruwira Mineral Field." By G. M. Stockley. Short paper No. 22, Geological Division, Dar es Salaam, Tanganyika Territory, Africa. Pp 22, plus map. Price Shs. 2/50.

Geology and Mineral Deposits of Oliphant's Hock Area, Cape Province. An explanation of Sheet No. 173, Oliphant's Hoek. Geological Survey, Pretoria, South Africa. Price 5s., including map, in two sheets. Pp. 144.

Queensland, Australia., Annual Report of the Under Secretary for Mines. Department of Mines, Brisbane, Australia. Pp. 188.

Nickel-Copper Mining, Smelting and Nickel-Refining Industry in Canada, 1938. Dominion Bureau of Statistics, Ottawa, Canada. Price 25c. Pp. 9.

Geology and Tectonics of the Outokumpu Ore Field and Region. By Heikki Väyrynen. Bulletin 124. Geologic Commission of Finland, Helsingfors. Pp. 91 and map.

Comptes Rendus, XIII. Geological Society of Finland. Helsingfors. Pp. 118.

Federated Malay States. Annual report on the Mines Department and the mining industries for 1938. By A. E. Kershaw, Mines Department, Kuala Lumpur, F.M.S. Pp. 34. Price $1 (local currency) or 2s. 4d.

Annuaire, 1938–1939, *Bureau d'Etudes Geologiques et Minieres Coloniales.* 12, rue de Bourgogne, Paris VII, France. Pp. 631.

"The Mineral Deposits of the Murchison Range, East of Leydsdorp," by O. R. Van Eeden, F. C. Partridge, L. E. Kent, and J. W. Brandt. Memoir 36, Geological Survey, Union of South Africa, at Pretoria. Price 7s. 6d. (including map).

Bergshantering Berättelse för 1938 *av Kommerskollegium.* Swedish official statistics, for industry and mining. Stockholm.

Canada's Geological Survey, at Ottawa, has recently issued the following preliminary reports: Paper 39-6, "Quyta Lake and Parts of Fishing Lake and Prosperous Lake Areas, Northwest Territories," by A. W. Jolliffe; price 10c; (maps only). Paper 39-8, "Reindeer Lake and Spalding Lake Map-Areas, Saskatchewan," by L. J. Weeks; price 10c. Paper 39-9, "Preliminary Map, Waconichi Map Area. Abitibi and Mistassini Territories, Quebec," by G. Shaw; price 10c. Paper 39-10, "Preliminary Map, Nelson Area, East Half, British Columbia," by H. M. A. Rice; price 10c. Paper 39-12. "Preliminary Map, La Pause Area, Abitibi and Temiscamingue Counties, Quebec," by J. W. Ambrose and H. C. Gunning; price 10c.

Dominion Bureau of Statistics, at Ottawa, has recently issued the following: "Annual Report on the Mineral Production of Canada, 1937," price 50c. Also "Report on Miscellaneous Metals in Canada" (26 metals), price 15c. Also "Summary Review of the Silver Mining Industry in Canada, 1938" (this includes data on production of lead, zinc, arsenic and cobalt); price 25c.

Canada's Bureau of Mines, at Ottawa, has issued the following: "The Canadian Mineral Industry in 1938," price 25c. Also "The Mining Laws of Canada," revised edition, compiled by Arthur Buisson; price 25c.

Brazil's National Department of Mineral Production, at Rio de Janeiro, has recently issued the following (in Portuguese): Bol. 31, "Report of the Director," by Avelino Ignacio de Oliveira, pages 227, plus numerous maps. Also Avulso No. 34, "Code of Mines (decree No. 24,642, of July 10, 1934), Laws and Subsequent Regulations," pages 102. Also Bol. No. 30, "Rutile in Goyaz," by O. H. Leonardos, pages 96, plus maps. Also Bo. No. 32, "Rocks in the Region of Bragança a Turí-assú (Para-Maranhao), by Henrique Capper Alves de Souza, pages 36, plus map. Also Avulso No. 35, "Gypsite," by Trajano de Mello Moraes, pages 15. Also Avulso No. 38. "Columbite and Tantalite in Rio Grande do Norte," by Henrique Capper Alves de Souza, pages 17. Also Avulso No. 39, "Beneficiation of Apatite in Ipanema, Sao Paulo," by Jayme Benedito de Araujo, pages 25.

Australasian Institute of Mining and Metallurgy Proceedings, New Series, No. 115, Sept. 30, 1939. Pp. 153 to 390 inclusive. This volume contains a collection of papers on the practice of Mount Isa Mines, Ltd., covering details of power-plant procedure, sintering, smelting, deep-well pumping as an aid to shaft sinking, geology, and boreholes used as ropeways at No. 2 ore shaft (unique in hoisting). It also contains a much longer collection of papers dealing with Mount Morgan's history and practice, the latter including mining methods, treatment of oxide ore and of sulphide ore, construction of reverberatory furnace bottoms, reverberatory smelting plant, research into causes of high tailings loss, and the gold clean-up at the oxide mill. The Australasian Institute held its first ordinary meeting, for 1939, at Mount Morgan and Mount Isa, respectively, during the latter half of August.

New Zealand's Geological Survey (branch of Department of Scientific and Industrial Research) at Wellington, N. Z., has issued the following: Report of the Geological Survey Branch for 1938-39, pp. 15. Also Bulletin 38 (New Series) entitled "The Geology of the Kaitangata-Green Island Subdivision, Eastern and Central Otago Divisions," by M. Ongley; pp. 90, plus 9 supplemental maps in colors, price 10s., 6d. Also Bulletin 39 (New Series), entitled "The Geology of the Naseby Subdivision, Central Otago," by J. H. Williamson; pp. 141, plus 8 supplemental maps in colors, price 21s.

New South Wales. Department of Mines, Annual Report for 1938. Pp. 171, price 10s., 6d. Published at Sydney, N. S. W., Australia.

Bolivia's Mineral Resources, Production, and Trade. Foreign Minerals Quarterly, Vol. 2, No. 4. Published by U. S. Bureau of Mines, Washington, D. C. (No charge). The 67 pages of this issue are devoted to a survey of mining and petroleum industries in Bolivia by Charles Will Wright, foreign mineral specialist, attached to Foreign Service, Department of State, in collaboration with American Consulate. La Paz, Bolivia. A comprehensive picture of the tin mining industry in Bolovia is given, occupying 25 pages, with attention to occurrences, operators, plants, mining and milling methods, costs, taxes, marketing, the cartel and quotas, together with a list of companies and mines. Similar treatment, though at shorter length, is given to the tungsten mining industry and the antimony industry, followed by still briefer descriptions of copper, lead, zinc, and gold mining. Nine pages are devoted to petroleum. The rest of the pamphlet deals with labor conditions, Government and mining organizations, mining laws, and other related subjects, with conclusions. This bulletin will be especially useful to all desiring information on the tin, tungsten and antimony mining industries in this Latin American country.

Summary of the

MARKETS

BUYING of major non-ferrous metals during December did not come up to the moderated level established in the preceding month and prices eased somewhat in export copper, zinc, and tin. Silver moved upward for a few days, abroad and here, on buying for account of India, but settled back to 34¾c., New York equivalent, before the end of the month. The *E.&M.J.* index of prices for December was 82.89, against 83.80 for November.

Sales of copper for domestic account totaled 29,592 tons during December, which compares with 51,630 tons in November, 68,423 tons in October, and 183,652 tons in September. Sales for 1939 totaled 804,749 tons, against 512,760 tons in 1938. The domestic quotation continued at 12½c., Valley, but the export price weakened, with quotations for the latter ranging from 12.30c. to 12.50c., f.a.s. Atlantic ports, as the month ended.

The British control established uniform delivered prices for copper, lead, and zinc in the United Kingdom at higher levels than those formerly based on the c.i.f. and ex warehouse quotations announced in September. However, the original prices at which Empire producers will ship non-ferrous metals to the United Kingdom have not been disturbed.

Demand for lead was relatively better than that of the other metals, largely because of favorable statistics and what is regarded in the trade as a more realistic price policy of producers. The market for lead closed strong at 5.50c., New York.

Zinc sales were light and nervousness over the price became evident as the month opened. One seller, with an intake problem, sold Prime Western zinc at 6c., St. Louis, on Dec. 1. On Dec. 29, the metal was available at 5.75c.

Quicksilver was higher on news that the foreign group advanced quotations. Molybdenum and aluminum were added to the "moral embargo" list.

UNITED STATES MARKET

1939	Electrolytic Copper— Domestic	Export	Straits Tin	Lead		Zinc
Dec.	(a) Refinery	(b) Refinery	New York	New York	St. Louis	St. Louis
1	12.275	12.900	52.375	5.50	5.35	6.00
2	12.275	12.925	52.375	5.50	5.35	6.00
4	12.275	12.900	52.125	5.50	5.35	6.00
5	12.275	12.900	52.000	5.50	5.35	6.00
6	12.275	12.900	51.750	5.50	5.35	6.00
7	12.275	12.800	51.250	5.50	5.35	6.00
8	12.275	12.800	51.125	5.50	5.35	6.00
9	12.275	12.700	51.000	5.50	5.35	6.00
11	12.275	12.700	51.125	5.50	5.35	6.00
12	12.275	12.700	51.250	5.50	5.35	6.00
13	12.275	12.700	51.000	5.50	5.35	6.00
14	12.275	12.600	50.500	5.50	5.35	6.00
15	12.275	12.550	50.500	5.50	5.35	6.00
16	12.275	12.550	50.500	5.50	5.25	6.00
18	12.275	12.575	50.250	5.50	5.35	6.00
19	12.275	12.550	50.375	5.50	5.35	6.00
20	12.275	12.525	50.500	5.50	5.35	6.00
21	12.275	12.525	49.750	5.50	5.35	6.00
22	12.275	12.450	50.250	5.50	5.35	6.00
23	12.275	12.450	50.250	5.50	5.35	6.00
25	—Holiday—					
26	12.275	12.450	49.875	5.50	5.35	6.00
27	12.275	12.425	50.000	5.50	5.35	6.00
28	12.275	12.400	49.375	5.50	5.35	6.00
29	12.275	12.400	49.500	5.50	5.35	5.75
30	12.275	12.400	49.500	5.50	5.35	5.75
	AVERAGES FOR MONTH					
	12.275	12.631	50.740	5.500	5.350	5.980
Dec.	**AVERAGES FOR WEEK**					
6	12.275	12.913	52.354	5.500	5.350	6.083
13	12.275	12.733	51.125	5.500	5.350	6.000
20	12.275	12.558	50.438	5.500	5.350	6.000
27	12.275	12.460	50.025	5.500	5.350	6.000
Dec.	**CALENDAR WEEK AVERAGES**					
2	12.275	12.938	53.458	5.500	5.350	6.333
9	12.275	12.800	51.542	5.500	5.350	6.000
16	12.275	12.633	50.813	5.500	5.350	6.000
23	12.275	12.513	50.229	5.500	5.350	6.000
30	12.275	12.415	49.650	5.500	5.350	5.900

SILVER, GOLD, AND STERLING EXCHANGE

1939	Sterling Exchange		Silver		Gold	
Dec.	"Checks"	"90-day demand"	(c) New York	London	London	(d) United States
1	3.87500	3.81250	34.750	23.5000	168s	$35.00
2	3.88500	3.81750	(e)	(e)	(e)	35.00
4	3.88500	3.81500	34.750	23.5000	168s	35.00
5	3.88000	3.81000	34.750	23.3750	168s	35.00
6	3.88500	3.81500	34.750	23.4375	168s	35.00
7	3.90000	3.83000	34.750	23.3125	168s	35.00
8	3.89000	3.82000	34.750	23.1250	168s	35.00
9	3.90000	3.83000	(e)	(e)	(e)	35.00
11	3.91000	3.84250	34.750	23.3125	168s	35.00
12	3.91500	3.84500	34.750	23.4375	168s	35.00
13	3.91500	3.84500	34.750	23.5000	168s	35.00
14	3.94000	3.87250	34.750	23.3750	168s	35.00
15	3.92000	3.85500	34.750	23.3750	168s	35.00
16	3.93000	3.87000	(e)	(e)	(e)	35.00
18	3.93500	3.87500	34.750	23.4375	168s	35.00
19	3.93000	3.86750	35.125	23.5000	168s	35.00
20	3.94500	3.88500	36.125	23.4375	168s	35.00
21	3.93500	3.87500	36.500	23.3750	168s	35.00
22	3.94000	3.88000	35.375	23.3125	168s	35.00
23	3.93500	3.87500	(e)	(e)	(e)	35.00
25	—Holiday—					
26	3.94000	3.88250	34.750	Holiday	Holiday	35.00
27	3.93750	3.87750	34.750	22.5000	168s	35.00
28	3.94000	3.88000	34.750	22.6875	168s	35.00
29	3.94000	3.88000	34.750	22.5000	168s	35.00
30	3.95000	3.89750	(e)	(e)	(e)	35.00
	AVERAGES FOR MONTH					
	3.91830	.....	34.956	23.263	....	35.00
Dec.	**AVERAGES FOR WEEK**					
6	3.87917	.....	34.750	.....	....	.....
13	3.90500	.....	34.750	.....	....	.....
20	3.93333	.....	35.100	.....	....	.....
27	3.93750	.....	35.344	.....	....	.....

Calendar week averages, New York silver: 2nd, 34.750; 9th, 34.750; 16th, 34.750; 23rd, 35.575; 30th, 34.750.

(e) No quotation (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(*a*) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(*b*) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the European War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(*c*) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c throughout December.

(*d*) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1939 Dec.	COPPER Standard Spot	COPPER Standard 3 months	COPPER Electro Bid	TIN Standard Spot	TIN Standard 3 months	LEAD Spot Buyers	LEAD Spot Sellers	LEAD 3 months Buyers	LEAD 3 months Sellers	ZINC Spot Buyers	ZINC Spot Sellers	ZINC 3 months Buyers	ZINC 3 months Sellers
1	Not quoted			230.000	230.000	Not quoted							
4	"	"	"	230.000	230.000	"	"	"	"	"	"	"	"
5	"	"	"	230.000	230.000	"	"	"	"	"	"	"	"
6	"	"	"	230.000	230.000	"	"	"	"	"	"	"	"
7	"	"	"	230.000	230.000	"	"	"	"	"	"	"	"
8	"	"	"	230.000	230.000	"	"	"	"	"	"	"	"
11	"	"	"	271.000	268.000	"	"	"	"	"	"	"	"
12	"	"	"	272.000	268.000	"	"	"	"	"	"	"	"
13	"	"	"	266.000	263.500	"	"	"	"	"	"	"	"
14	"	"	"	259.750	256.500	"	"	"	"	"	"	"	"
15	"	"	"	258.750	257.000	"	"	"	"	"	"	"	"
18	"	"	"	258.500	256.000	"	"	"	"	"	"	"	"
19	"	"	"	257.000	256.000	"	"	"	"	"	"	"	"
20	"	"	"	256.000	255.000	"	"	"	"	"	"	"	"
21	"	"	"	250.750	250.000	"	"	"	"	"	"	"	"
22	"	"	"	255.500	254.500	"	"	"	"	"	"	"	"
25	"	"	"	Holiday	Holiday	"	"	"	"	"	"	"	"
26	"	"	"	Holiday	Holiday	"	"	"	"	"	"	"	"
27	"	"	"	250.000	249.250	"	"	"	"	"	"	"	"
28	"	"	"	247.500	246.750	"	"	"	"	"	"	"	"
29	"	"	"	247.750	247.750	"	"	"	"	"	"	"	"
Average for month	.....	.....	.....	248.974	.....	.....	.....	.....	.....	.....	.....	.....	.....

Prices for tin are the official prices of the London Metal Exchange, in long tons (2240 lb.). Trading in other metals remained suspended.

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(Jan. 2, 1940)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	20c.
Antimony, domestic, spot, lb	14.00c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	75c.
Calcium, lb., ton lots 97 @ 98 per cent	Nominal
Chromium, 97 per cent grade, lb	89c.
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carolads, lb	27c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$40.00
Quicksilver, flask of 76 lb., 100 flasks or more	$145.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$6.50
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 48 @ 50% Cr_2O_3 c.i.f. Atl. ports, long ton	$26.00@$30.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.25
Mesabi bessemer	$5.10
Old Range non-bessemer	$5.10
Mesabi, non-bessemer	$4.95
Lead (Galena) 80 per cent, Joplin, Mo., ton	$61.00@$67.00
Manganese Ore, c.i.f. Atlantic ports, long ton unit of Mn:	
52 @ 55 per cent	(b) 49c.
50 @ 52 per cent	(b) 49c.
44 @ 48 per cent	(b) 44c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	$23.50
Domestic, 65 per cent and upward	(a)$22.00@$24.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$39.00

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	3c
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$4.75
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.42
Sodium Sulphate, bulk ton	$13.00@$15.00

ALLOYS

Berrylium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, lb	11c.
Ferromanganese, 78 @ 82 per cent, gross ton	$100.00
Ferromolybdenum, 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, gross ton	$69.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$2.00@$2.10

NON-METALLIC MINERALS

Asbestos, f.o.b. mines, ton:	
Canadian (Quebec)	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$45
Shorts	$12@$16.50
Vermont	
Shingle stock	$57
Paper stock	$40
Cement stock	$25
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$6.50
Bauxite, long ton:	
Domestic, chemical, 55 @ 58 per cent	$6.00@$7.00
Domestic, abrasive, 80 @ 84 per cent	$12.00@$14.00
Dalmatian, 50 @ 55 per cent	(a)$6.00@$7.00
French, 56 @ 59 per cent	(a)$7.00@$8.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$22.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in	25@30c.
2 x 2 in	40@50c.
3 x 3 in	$1.00@$1.20
3 x 4 in	$1.30@$1.40
3 x 5 in	$1.50@$1.70
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12c.
Silica, in bags, 325 mesh, ton	$18.00@$40.00
Sulphur, Texas mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$9.00@ $9.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

(a) Nominal

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$23.50
Basic	$22.50
No. 2 Foundry	$23.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1938	1939	1938	1939	1938	1939
January	44.750	42.750	19.895	20.305	499.895	466.775
February	44.750	42.750	20.159	20.370	501.722	468.472
March	44.446	42.750	20.088	20.280	498.394	468.370
April	42.750	42.750	18.880	20.031	498.046	467.778
May	42.750	42.750	18.731	20.123	496.673	467.988
June	42.750	41.955	18.945	19.505	495.772	468.137
July	42.750	34.944	19.356	16.952	492.855	468.031
August	42.750	35.951	19.389	17.719	488.044	460.383
September	42.750	36.956	19.300	22.178	480.240	398.820
October	42.750	35.726	19.613	22.736	476.785	400.350
November	42.750	34.750	19.834	23.378	470.587	391.457
December	42.750	34.956	20.083	23.263	466.798	391.830
Year	43.225	39.082	19.523	20.570	488.818	443.199

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine, London pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot			
	Domestic		Export		Standard		(a) Electrolytic	
	1938	1939	1938	1939	1938	1939	1938	1939
January	10.198	11.025	9.908	9.912	41.387	43.125	45.387	48.440
February	9.775	11.025	9.525	9.735	39.597	42.188	43.563	47.375
March	9.775	11.025	9.496	9.888	39.772	42.938	43.582	48.120
April	9.775	10.265	9.443	9.820	39.306	42.031	43.408	47.833
May	9.375	9.833	8.801	9.738	36.668	41.656	40.852	47.528
June	8.775	9.775	8.500	9.738	35.235	41.986	39.417	47.528
July	9.585	9.976	9.573	9.944	39.744	42.899	44.405	48.863
August	9.900	10.261	9.844	10.211	40.591	44.685	45.909	50.409
September	10.028	11.635	9.943	11.685	41.864	(b)	47.148	(b)
October	10.760	12.215	10.713	12.491	45.646	(b)	51.190	(b)
November	11.025	12.275	10.569	12 929	45.244	(b)	51.080	(b)
December	11.025	12.275	10.023	12.631	43.428	(b)	48.988	(b)
Year	10.000	10.965	9.695	10.727	40.707	c42.689	45.411	c48.262

New York quotations, cents per pound. London, pounds sterling per long ton, (a) Bid quotation. (b) No quotations. (c) Average for eight months.

LEAD

	New York		St. Louis		London			
	1938	1939	1938	1939	1938 Spot	1938 3 mos.	1939 Spot	1939 3 mos.
January	4.870	4.826	4.720	4.676	16.135	16.253	14.534	14.744
February	4.632	4.805	4.482	4.655	15.402	15.525	14.283	14.417
March	4.500	4.824	4.350	4.674	15.992	16.075	14.660	14.860
April	4.500	4.782	4.350	4.632	15.579	15.623	14.337	14.533
May	4.400	4.750	4.250	4.600	14.210	14.376	14.483	14.679
June	4.148	4.800	3.998	4.650	13.969	14.012	14.564	14.651
July	4.882	4.854	4.732	4.704	14.921	15.034	14.753	14.856
August	4.900	5.043	4.750	4.893	14.371	14.480	16.040	15.885
September	4.998	5.449	4.848	5.299	15.249	15.401	(a)	(a)
October	5.100	5.500	4.950	5.350	16.173	16.313	(a)	(a)
November	5.091	5.500	4.941	5.350	16.088	16.223	(a)	(a)
December	4.842	5.500	4.692	5.350	15.106	15.275	(a)	(a)
Year	4.739	5.053	4.589	4.903	15.266	15.383	b14.707	b14.828

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton. (a) No quotations. (b) Average for eight months.

TIN

	Straits New York		Standard, Spot London	
	1938	1939	1938	1939
January	41.548	46.404	183.619	215.435
February	41.373	45.640	183.144	213.906
March	41.219	46.213	183.473	215.375
April	38.430	47.160	168.612	218.389
May	36.885	49.031	162.693	225.591
June	40.376	48.853	177.429	227.511
July	43.428	48.548	192.542	229.833
August	43.276	48.793	192.966	229.869
September	43.369	64.588	193.733	229.292
October	45.263	55.580	206.911	229.943
November	46.262	52.322	213.909	230.000
December	46.180	50.740	214.450	248.974
Year	42.301	50.323	189.457	226.177

New York quotations cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
	1938	1939	1938 Spot	1938 3 mos	1939 Spot	1939 3 mos.
January	5.000	4.500	14.994	15.173	13.682	13.887
February	4.813	4.500	14.408	14.589	13.522	13.780
March	4.417	4.500	14.364	14.477	13.728	13.961
April	4.141	4.500	13.729	13.919	13.443	13.637
May	4.042	4.500	12.682	12.869	13.717	13.938
June	4.131	4.500	12.890	13.104	14.023	14.223
July	4.745	4.516	14.144	14.371	14.235	14.435
August	4.750	4.719	13.467	13.675	14.628	14.761
September	4.846	6.104	14.040	14.246	(a)	(a)
October	5.012	6.500	15.083	15.232	(a)	(a)
November	4.924	6.500	14.366	14.550	(a)	(a)
December	4.500	5.980	13.709	13.861	(a)	(a)
Year	4.610	5.110	13.990	14.172	(b)13.872	(b)14.078

St. Louis quotations, Prime Western, cents per pound London, pounds sterling per long ton. (a) No quotations. (b) Average for eight months.

CADMIUM AND ALUMINUM

	Cadmium			Aluminum	
	1938 (a)	1939 (a)	1939 (b)	1938	1939
January	117.500	70.900	58.400	20.000	20.000
February	117.500	67.500	55.000	20.000	20.000
March	117.500	65.278	54.259	20.000	20.000
April	102.500	52.500	50.000	20.000	20.000
May	102.500	52.500	50.000	20.000	20.000
June	102.500	52.500	50.000	20.000	20.000
July	102.500	52.500	50.000	20.000	20.000
August	99.722	56.204	53.704	20.000	20.000
September	84.000	66.700	64.200	20.000	20.000
October	80.000	77.100	74.600	20.000	20.000
November	77.717	77.500	75.000	20.000	20.000
December	72.500	77.500	75.000	20.000	20.000
Year	98.037	64.057	59.180	20.000	20.000

Aluminum in cents per pound, 99 plus per cent grade. Cadmium, cents per pound; (a) average of producer's and plater's quotations; (b) producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1938	1939	1938	1939	1938	1939
January	13.750	11.670	79.240	77.440	36.000	34.440
February	13.750	11.250	76.455	85.227	36.000	35.000
March	13.750	11.269	72.444	87.278	36.000	35.000
April	13.654	11.500	71.019	90.800	36.000	35.000
May	12.460	11.712	74.640	86.769	33.400	35.000
June	11.731	12.000	80.731	86.615	33.231	35.000
July	11.030	12.000	76.860	86.960	36.000	35.000
August	10.880	12.000	75.500	84.407	37.000	35.333
September	11.310	12.910	74.420	140.000	39.000	40.080
October	12.060	14.000	73.480	145.600	37.960	41.120
November	12.250	14.000	74.065	134.978	36.217	40.000
December	11.567	14.000	76.769	141.200	34.000	40.000
Year	12.349	12.359	75.469	103.940	35.901	36.748

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk 13.415 for December. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum is dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1938	1939	1938	1939	1938	1939
January	24.50	21.50	23.50	20.50	24.00	21.00
February	24.50	21.50	23.50	20.50	24.00	21.00
March	24.50	21.50	23.50	20.50	24.00	21.00
April	24.50	21.50	23.50	20.50	24.00	21.00
May	24.50	21.50	23.50	20.50	24.00	21.00
June	23.73	21.50	22.73	20.50	23.23	21.00
July	20.50	21.50	19.50	20.50	20.00	21.00
August	20.50	21.50	19.50	20.50	20.00	21.00
September	20.50	22.50	19.50	21.50	20.00	22.00
October	21.50	23.50	20.50	22.50	21.00	23.00
November	21.50	23.50	20.50	22.50	21.00	23.00
December	21.50	23.50	20.50	22.50	21.00	23.00
Year	22.686	22.083	21.686	21.083	22.186	21.583

Iron, dollars per long ton. F. o. b. Mahoning and Chenango Valley furnaces.

PERSONAL ITEMS

G. O. Ramsay, formerly assistant metallurgist of Emperor Gold Mining Co., Fiji, has returned to Australia.

Harry J. Wolf, mining engineer, has moved his office from 34 East 11th St. to 501 5th Ave., New York City.

L. E. Davis has been appointed instructor in ore dressing at Michigan College of Mining and Technology at Houghton, Mich.

W. E. Dunkel is operating the Golden Zone mine near Colorado station, Alaska, on the Alaskan Government railroad east of Anchorage.

Morris J. Elsing, accompanied by Mrs. Elsing, arrived in the United States from Japan on Dec. 7, after having spent two and a half years in that country.

Russell B. Woakes has left Australia for Burma to assume the position of assistant general manager of Burma Corporation, Ltd.

John Swart is at present engineer in charge of design and construction of the Cerro de Pasco Corporation's lead-zinc concentrator at Oroya, Peru.

P. R. Middleton is now manager of Copeland Gold Mines, N.L., and Australian Development, N.L., both operating at Norseman, Western Australia.

L. R. Jackson, general manager of Ariston Gold Mines (1929) Ltd., Prestea, Gold Coast Colony, has returned to the mine after a holiday in England and France.

F. H. Brownell, of the American Smelting & Refining Company, has been elected chairman of the board of directors of Revere Copper & Brass Company succeeding the late Barton Hazelton.

Karl O. McConnell, formerly engineering aide in the War Department, at Bruce, Wis., is now with Davenport Mining & Reduction Company, Kingman, Ariz.

G. T. H. McMahon, formerly on the staff of Ruab Australian Gold Mining Company, is now with Australasian Petroleum Company, Pty., Ltd., Port Moresby, Papua.

F. W. Reinmiller, formerly with Cerro de Pasco Copper Corporation, at Morococha, Peru, and later at Beaver, Ark., is now at the Bald Eagle mine, Gustine, Calif.

Charles H. Thurman, consulting gold dredging engineer, has moved his offices from 420 Market St., San Francisco, Calif., to the Russ Building at 235 Montgomery St.

J. A. Lyon, engineer-manager for the Champion City Mines, Inc., operating the Lucky Boy silver-lead mine near Hawthorne, Nev., has been in San Francisco to purchase additional mine equipment.

T. W. Dickinson, consulting engineer for DeBeers diamond mines at Kimberley, South Africa, has returned to Kimberley after a soujourn of several months in the United States.

H. G. Hymer, formerly engaged as mining engineer and mine superintendent on the Mesabi range, has joined the staff of the General Chemical Company as assistant mining engineer.

Joseph M. Johnson, of Ishpeming, Mich., chief engineer on the Marquette iron range for the Oliver Iron Mining Company, has been elected president of the Marquette Mining Engineers' Club.

D. B. Sterrett has resigned as director and as mine manager of Vidette Gold Mine, operating in British Columbia. **Richard Avison,** formerly mine superintendent, has been made mine manager.

C. W. Gudgeon, formerly in charge of operations at the Costerfield gold-antimony mine, Victoria, Australia, is supervising a property at Batlow, New South Wales, for Burma Malay Tin, Ltd.

A. A. Robertson has resigned as head of the metallurgy department at the Melbourne Technical College to accept appointment as works manager for Pope Products, Ltd., Adelaide, South Australia.

Russell Cornell recently visited the St. Joseph Lead Company's Aguilar lead-zinc mine at Jujuy, Argentina. **William Faust,** a recent graduate in metallurgy from Michigan Tech, has joined the Aguilar staff.

James E. Atkinson, mining engineer with Marsman & Company, Inc., of Manila, is on leave of absence in the United States. He may be addressed at Apartment 110, 2414 Telegraph Ave., Berkeley, Calif.

Arnold H. Miller, vice-president of Certain-teed Products Corporation, of New York, recently completed an extensive tour of inspection of the company's mines and plants, in the course of which he addressed various business groups.

George H. Cliff, formerly metallurgist of Big Bell Mines, Ltd., Big Bell, Western Australia, has been appointed assistant general manager of the company. He has recently returned to Australia from a visit to Canada.

Ian W Morley, who has been an inspector of mines in Western Australia for some years, has been appointed assistant State Mining Engineer and assistant chief inspector of mines in the Queensland Department of Mines.

R. E. Legg, former manager of the Surf Inlet mine, has left Vancouver for Sault Ste. Marie, Ontario, to take over the position of plant superintendent at the smelter operated by the Chromium Mining & Smelting Corporation.

Charles White Merrill, supervising engineer, Mineral Production and Economics Division, United States Bureau of Mines, San Francisco, Calif., has been elected chairman of the San Francisco Section A.I.M.E. **Herbert A. Sawin** was reelected secretary and treasurer.

Dr. Oliver E. Buckley, executive vice-president of the Bell Telephone Laboratories, New York, has been elected chairman of Engineering Foundation, research organization of the national engineering societies. Dr. Buckley, who has been vice-president of the Foundation, succeeds the late Professor George E. Beggs, of Princeton University.

Felix E. Wormser, of New York, a director of the A.I.M.E. and secretary-treasurer of the Lead Industries Association, spoke before the fall meeting of the American Society of Agricultural Engi-

Governor C. A. Bottolfsen of Idaho, poses at the control of the motor of a train of 46 cars of ore as it emerged from the two-mile tunnel of Bunker Hill & Sullivan Mining & Concentrating Company at Kellogg, Idaho. He was a visitor at the sessions of the North Idaho Chamber of Commerce held recently at Kellogg.

neers in Chicago on Dec 6, stressing the importance to agricultural engineers of a thorough knowledge of paint.

R. M. Preston, managing director of Rio Tinto Company, Ltd., was elected president of the Institute of Metals at the recent meeting held in London. Vice-presidents are **Dr. S. F. Dorey, Sir George Preece** and **A. J. G. Smout,** of Imperial Chemical Industries, Inc.

Frederick M. Feiker, formerly an officer of the McGraw-Hill Publishing Co., has resigned as executive secretary of the American Engineering Council to become dean of the School of Engineering of the George Washington University. Mr. Feiker succeeds Dean John R. Lapham, who died last October.

J. McNiven, superintendent of Negus Mines, Ltd., and **George Carter,** of Consolidated Mining & Smelting Company, were on Dec. 13 last elected councillors of Yellowknife administrative district, at Yellowknife, N.W.T., following the first municipal election ever held in the Northwest Territories of Canada.

Burrel R. Hatcher recently announced his retirement on Jan. 1, 1940, as manager of the Southwestern department of the American Smelting & Refining Company. Mr. Hatcher has been with the company for 21 years, and will continue in a consulting capacity. **W. H. Loerpabel,** who has been in charge of units of the company in Mexico and the Pacific Northwest, will succeed Mr. Hatcher as manager of the Southwestern department.

Dr. Andrew Cowper Lawson, professor of geology and mineralogy at the University of California, was recently awarded the Penrose medal, the highest honor of the Geological Society of America, the award being made for "eminent research in pure geology and outstanding original contributions and achievements which mark a decided advance in the science of geology." Dr. Lawson is 77.

George W. Danehy, formerly engineer for the Tonopah Belmont Development Company, now living at Reno, has established an equipment agency and mining consultation service firm in association with **J. Benj. Parker,** metallurgist, with offices in Reno.

E. C. Bitzer, who went to the Federated Malay States from the Philippines in 1938, to take charge of the new gold tailings plant at Raub, Penang, has returned to the United States, where his permanent address is 1200 12th St., Golden, Colo. He was the author of the article describing Benguet Consolidated's Cal Horr mill (of which he was superintendent), at Baguio, in the Philippines, which was published in *E. & M. J.'s* Philippine Number, August, 1937.

W. R. Wade, of Libby, Mont., is closing down the Branagan mine for the winter months, after a season's successful development work. He expects to build the first 100-ton unit of a 200-ton mill in the spring. The plant will be electrically driven. Mr. Wade will be at his office at 315 Montgomery St., San Francisco, for the next few months.

William O. Vanderburg, United States Bureau of Mines engineer stationed at Reno, has been directing work of a field crew in prospecting, with two diamond drills, scheelite deposits in the Nightingale district, western Pershing County, Nev. He is now directing similar work in testing nickel deposits near the old Key West mine, in Clark County, Nev., and has been succeeded at Nightingale by **John East,** who was stationed formerly at Denver.

▼ ▼ ▼

OBITUARY

J. E. Hayden, of Marble, Minn., engineer for the Mesaba-Cliffs Mining Company, died on Dec. 8.

James Bryant Tonking, consulting mining engineer, died at Boonton, N. J., on Dec. 7 at the age of 82.

James Gross, master mechanic for the Jones & Laughlin properties on the Mesabi for 31 years, died on Nov. 12 at Hibbing, Minn.

Edmund Shaw, Sr., mining engineer and formerly editor of *Rock Products,* died on Dec. 12 in Burbank, Calif., at the age of 69.

John C. Brennon, mining engineer, a director of the International Mining Corporation, died on Dec. 2 at the age of 61. Mr. Brennon was a graduate of the Michigan College of Mines.

John A. Traylor, president of the Royal Tiger Mines Company, of Colorado, and founder of the Traylor Engineering & Manufacturing Company, died recently.

John Henry Pearce, of Hibbing, Minn., an engineer for Great Northern Iron Ore Properties and a pioneer on the Mesabi range, died on Nov. 12 last at the age of 65.

Leonard Wills, underground foreman at Central Eureka mine, at Sutter Creek, Calif., died at his home in that community on Nov. 21 at the age of 47. He was a native of Cornwall, England, and came to the United States at the age of seventeen, settling in Arizona.

Guy E. Mitchell, for many years chief of the United States Geological Survey's executive division, died in Washington on Dec. 5. Mr. Mitchell served for 32 years with the Geological Survey. In recent years he has been librarian of the bureau.

Warren Gilkison, superintendent of the Hochschild mining properties in Potosi, Bolivia, died on Nov. 10 last at the age of 37. Mr. Gilkison was an alumnus of the Colorado School of Mines and had had extensive experience in mining in the Philippines and Mexico.

William Ernest Bennett, secretary-treasurer of and a director in Pacific Tin Consolidated Corporation, 120 Broadway, New York City, died in New York on Dec. 20. Mr. Bennett was formerly associated with Guggenheim Brothers and at the time of his death was a director in many mining corporations.

Oscar H. Hershey, long a consultant geologist for Bunker Hill & Sullivan Mining & Concentrating Company, at Kellogg, Idaho, and formerly with the United States Geological Survey, as well as a member of the firm of Burch, Caetani, & Hershey, now Hershey & White, of San Francisco, died in Wilmington, Del., on Dec. 11 at the age of 65.

Frank Ludlam, assistant secretary and assistant treasurer of the International Nickel Company, Inc., died in New York on Dec. 8 at the age of 66. He was born at Bloomfield, N. J., and attended the Lyon School and the Columbia School of Mines, where he studied architecture. After spending some years in the architectural field, he joined the Carnegie Steel Company at Pittsburgh. He became associated with International Nickel in 1903.

Spencer Penrose, last survivor of the four Penrose brothers of the famous Philadelphia family of that name—the three others being Boies, United States Senator from Pennsylvania; Richard A. F., mining engineer, and Dr. Charles B., a surgeon—died at Colorado Springs, Colo., on Dec. 7 at the age of 74. Mr. Penrose, after graduation from Harvard, joined the rush to the Cripple Creek gold fields in the 80s, and there amassed a fortune, which he spent lavishly in industrial and civic development. He was associated with Daniel C. Jackling, and was active in the formation of the Utah Copper Company. He built the Will Rogers Shrine of the Sun, on Cheyenne Mountain, and invested millions in the Broadmoor hotel, at Colorado Springs, and in public parks, a zoo, and highways. He was long prominent in the councils of the Republican party. Mr. Penrose is survived by his widow, Mrs. Julie Penrose.

Fritz John Frank, president of the Iron Age Publishing Company, died on Dec. 8 at Mount Kisco, N. Y. He was 68 years old and is survived by his widow, Mrs. Anna Raynor Frank. Mr. Frank was born at Emporia, Pa., and graduated from Rollins College, Winter Park, Fla., with the degree of batchelor of arts in 1896. He began his publishing career by joining *The Colliery Engineer,* later *Mines and Minerals,* as advertising manager. In 1906 he joined the *Mining and Scientific Press* as its Chicago representative, continuing with that publication until 1910, when he became associated with *The Iron Age* as advertising manager. In 1911 Mr. Frank was made secretary of the David Williams Publishing Company, predecessor of the Iron Age Publishing Company, and in 1918 was elected vice-president. In 1919 he became president, a position which he occupied until his death. In addition to his executive position with *The Iron Age,* Mr. Frank was also executive vice-president of the Chilton Company, and held directorships in the Robbins Publishing Company, the Business Papers International Corporation, the Newton Falls Paper Company, and the Savage Arms Company.

What Metal Statistics Show

PRODUCERS of copper and lead expect their high rate of activity will continue through the winter months, but with the sudden drop in the price of zinc due to imports from abroad, enthusiasm in the Tri-State and in other zinc-producing districts has received a setback. It is doubtful if zinc output will again soon reach the high it did in December. Production of zinc, all grades, totaled 57,941 tons, the highest monthly record from domestic ores during that month.

The Copper Institute is expected to release complete figures on domestic copper production during 1939 in the near future, and will resume the issuance of monthly domestic figures beginning 1940. Statistics from the foreign group will not be included.

The American Bureau of Metal Statistics has released figures for publication showing mill and foundry shipments of copper (copper content) for the first eleven months of 1939. The figures appearing in the second column, net shipments, are regarded by many in the industry as one of the best indicators of the rate of consumption of copper by mills and foundries. The figures, in short tons, follow:

1939	Copper Shipments (a) Gross	(b) Net
January	65,000	58,500
February	59,500	53,590
March	64,500	58,000
April	59,000	53,000
May	60,000	54,000
June	62,900	55,000
July	60,000	54,000
August	71,000	63,000
September	82,000	73,000
October	96,090	84,000
November	91,000	82,000
Totals	770,000	688,000

(a) Estimated copper content of shipments ex mills of all kinds and ex foundries.

(b) Estimated net shipments of copper content ex mills and ex foundries, allowing for normal return of processing scrap. Consequently, this column represents approximately current rate of consumption.

The figures for copper are rounded off inasmuch as they are estimates rather than specific accountings.

The State Department in Washington announced on Dec. 21 that, in view of information submitted at the hearings on the Chilean trade agreement, it has been decided that no concessions in the import tax on copper would be made in the treaty now being negotiated.

The official statement, which broke all precedent by announcing in advance of the conclusion of a treaty the decision reached in the case of a commodity, was issued to block further sharp criticism of the trade agreement program, according to observers in Washington.

In copper circles it was believed, until last week, that the State Department intended to reduce the tax, even though opposition to a reduction in the tax has been strong, coming from State officials, producers, and labor factions in the copper-producing areas of this country.

Hearings on the copper import tax, under the proposed Chilean agreement, were completed in Washington Nov. 28.

The Trade Agreements Act will expire June 12, 1940, unless renewed by Congress.

QUICKSILVER—A summary of the United States Bureau of Mines' latest report on the position of quicksilver in this country follows, all figures in flasks of 76 pounds:

	Sept.	Oct.
Consumption	2,600	2,800
Production, domestic	1,500	1,590
Imports	189	200
Exports	128	364
Consumer's stocks (a)	9,200	8,500
Stocks in dealers' and importers' hands	3,000	2,400
Stocks held by producers (b)	318	178
Total stocks	12,518	11,078

(a) Stocks at consumer's plants, in bonded warehouses and owned by consumers, and in transit. (b) Stocks held by companies reporting to the Bureau (34 mines).

E & M J Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922-3-4)

1929	110.33	1934	69.56
1930	82.87	1935	74.66
1931	60.20	1936	73.45
1932	48.26	1937	90.86
1933	59.79	1938	73.67

	1937	1938	1939
January	87.03	75.56	77.12
February	91.68	73.43	76.89
March	103.78	72.41	77.09
April	98.62	71.19	74.79
May	93.25	69.15	73.61
June	93.21	67.55	73.17
July	93.82	72.95	71.95
August	95.28	73.94	73.88
September	94.33	74.70	83.07
October	85.26	77.61	84.25
November	78.91	78.36	83.80
December	75.18	77.13	82.89

LEAD—Producers expect another reduction in domestic stocks of refined lead for December, as shipments to consumers continue at a high rate.

Stocks of refined lead were reduced by 15,902 tons during November, which was in line with expectations.

The October and November figures on refined lead, according to the American Bureau of Metal Statistics, in short tons, follow:

	Oct.	Nov.
Stock at beginning	97,473	73,963
Production:		
Domestic ore	38,903	44,748
Secondary and foreign	3,660	3,719
Totals	42,563	48,467
Domestic shipments	66,060	64,365
Stock at end	73,963	58,961

ZINC—The October, November and December statistics of the American Zinc Institute, covering all grades, are summarized as follows in tons:

	Oct.	Nov.	Dec.
Stock at beginning	95,615	72,495	61,522
Production	50,117	53,524	57,941
Production daily rate	1,617	1,784	1,869
Shipments	73,327	64,407	53,468
Unfilled orders	79,539	66,197	53,751
Stock at end	72,405	61,522	65,995

The Prime Western division (common grades only) reports on its operations for 1939 as follows, in tons:

	Production	Shipments	Stock At End
Jan.	19,659	16,789	51,875
Feb.	18,266	15,927	54,214
March	20,813	18,505	56,522
April	20,152	19,116	57,558
May	19,756	18,506	58,808
June	17,881	17,483	59,206
July	17,263	18,320	58,149
Aug.	17,528	20,542	55,135
Sept.	18,049	27,023	46,161
Oct.	21,432	31,572	36,021
Nov.	23,626	28,706	30,941
Dec.	25,497	26,386	30,052
Total	239,922	258,872	.....

Zinc Statistics of British Empire, France, and Germany

Production and apparent consumption of zinc in the British Empire, France, and Germany during 1938, summarized from the A.B.M.S. Year Book, in metric tons:

	British Empire	France	Germany
Production of zinc in ore (recoverable)	424,400	12,300	255,700
Production, zinc dust	.....	.....	14,000
Production, slab zinc, total	293,200	66,600	312,200
Production, slab zinc, electrolytic	237,000	29,000	75,000
Consumption, slab zinc	281,100	89,200	335,700
Capacity for slab zinc	345,000	134,000	430,000

Besides their electrolytic production both Great Britain and Germany produce some high-grade zinc by the New Jersey reflux-refining process.

In the above accounting the British Empire is reckoned as being inclusive of Great Britain, Australia (inc. Tasmania), Newfoundland, Canada, Burma, and Rhodesia. France is reckoned as inclusive of Algeria, Tunis, Morocco and Indo-China. Germany as inclusive of the Sudetenland of Bohemia and of Poland.

Estimates of metallurgical capacity are the aggregates of the reports by the several proprietors, except as to Germany, in respect of which some other authentic information has been introduced.

Truck-type wagons are employed at the mine of the Mountain Copper Company, Ltd., to haul gold ore from surface operations 17 miles northwest of Redding, Calif.

CALIFORNIA

Compensation Insurance Rates Are Reduced

California Commissioner makes new basis effective at first of year — La Grange Placer Mines, Ltd., plan operations in Trinity County—Rotary furnace to be installed at quicksilver mine

▶ Welcome news to California mine operators is the announcement of substantial reductions in compensation insurance rates by A. Caminetti, Jr., California Insurance Commissioner. Effective Jan. 1, 1940, rates were reduced in all of the principal classifications, save for surface workers at lode mines, for which the rate is raised 40c., from $3.92 to $4.32. The greatest reduction was made in the dragline dredge rate, amounting to $1.09. Following are the new rates based on each $100 of payroll: Underground, from $9.17 to $8.89; surface, placer, $4.27 to $4.24; surface, lode, $3.92 to $4.32; milling, $2.21 to $1.97; bucket ladder dredges, $3.99 to $3.96; and dragline dredges, from $5.40 to $4.31.

▶ La Grange Placer Mines, Ltd., owners of the well-known La Grange hydraulic unit near Weaverville, Trinity County, are reported to be planning early reopening of the property, with field men and repair crews already at work. Operations were suspended twenty years ago, and the water which previously supplied the mine has been used during the past few years by the California State Highway Department in moving a large yardage of ground by hydraulic methods for the rerouting of Highway 299 over Oregon Mountain. This work has now been completed, with the water again available for mining. Lyman Stookey is president and general manager of the company.

▶ Early installation of a 40-ton rotary furnace is planned by the Contact Mining Company at its property near Pine Flat, Sonoma County and about 19 miles from Healdsburg. The mine is currently producing from two to three flasks of quicksilver a day, and fifteen men are employed. H. G. Walker is manager.

▶ Increased operations are planned at the properties of United States Chrome Mines, Inc., about 4 miles from Rattle Snake Bar, in El Dorado County, after conclusion of an agreement between the company and Rustless Iron & Steel Company, of Baltimore, according to a recent report from Placerville. The new work will be conducted by Rustless Mining Company, subsidiary of Rustless Iron & Steel, under the direction of H. F. Byram, vice-president, and will include increased underground activities and enlargement of the present milling plant. United States Chrome Mines also plans to resume work at its holdings in San Luis Obispo County, where deposits of chrome have been developed.

▶ Comprehensive development is scheduled for the Hardscrabble and Laurel gold properties, near Angels Camp, Calaveras County, leased recently by the Comstock Gold Point Mines Company from E. Slaney. John N. Richardson is general manager of the company, which also operates mining properties at Currant Creek, Nye County, Nev.

▶ Successful dragline operations are carried on in Webber Creek some 10 miles west of Placerville, El Dorado County, where Lemroh Mining Company has recently installed a modern dragline dredge unit on the property of George Williamson. Enough ground is available for a campaign exceeding six months duration. The company is financed by the George A. Hormel & Company interests, of Los Angeles.

▶ Payment of a 5c. dividend on Dec. 15 brings the disbursement during 1939 to a total of 45c. per share for Central Eureka Mining Company, C. C. Prior, president. At the property in Sutter Creek ore has been opened up from the winze on the 3,100, 3,400, and 3,500 sublevels, with the drift now driven from the 3,500 station to the location of the development to be completed early next year. Further exploration will be undertaken to determine the extent of the orebody. Operations are directed by James Spiers, superintendent.

▶ Allied Mines, Inc., have moved the milling plant at the App shaft near Jamestown, Tuolumne County, to the adjoining Dutch shaft, and capacity has been increased to 60 tons by installation of new machinery. The plant is operated on a three-shift basis, with underground work confined to drifting on the 600-ft. level in the Dutch property to contact orebodies under the 300-ft. level of the abandoned App shaft. Twenty-three men are employed under R. K. Brown, superintendent, in charge of operations. S. B. Wood, Jr., is president, and the holdings include the Heslop, Sweeney, Dutch, and App mines.

▶ Payment of an 80 per cent dividend, following two previous disbursements of 10 per cent each, has recently been made to stockholders by Alhambra-Shumway Mines, Inc., operating the Alhambra-Shumway mine, near Kelsey, El Dorado County. The property has attracted considerable attention among Western mining men because of the high-grade orebody discovered recently, from which a production of $600,000 has been shipped to the United States Mint in San Francisco and the Selby smelter. Reopened a few years ago by Wilbur Timm, of Oakland, the mine subsequently was taken over by a group of Fresno and Coalinga business men and equipped with a 25-ton Straub milling plant. The company is currently mining about 20 tons of ore a day, with 30 men employed. Ray Hendricksen is superintendent. Several adjoining mines are to be worked in the near future. Clarence Brown, of Hollywood, has acquired the near-by Atlanta mine, H. G. O'Hanlon, of San Francisco, has taken a lease and bond on the Shumway property of the Alhambra group and expects to start development work shortly, and E. J. Harp, of Fresno, has taken over the Altermott mine, comprising the Blue Point, Yellow Jacket, and Lone Springs claims, from Jack Altermott, Kelsey.

▶ Operations have been resumed after a brief shutdown at the Fremont-Gover properties near Drytown, Amador County, and immediate plans include deepening the 2,900-ft. Fremont shaft and the 1,500-ft. Gover shaft, both containing three compartments. Current work is centered in mining a large body of surface ore by open-pit methods. W. S. Hutchinson is superintendent.

▶ The Culver-Baer quicksilver mine, east of Cloverdale, Sonoma County, has been leased and optioned by W. A. Johnson and associates of American Concrete & Steel Pipe Company, of Los Angeles, and L. T. Pockman, of San Francisco. Development work has been started, and a rotary furnace is to be installed as soon as sufficient ore has been blocked out.

▶ The shaft of the old Rainbow mine, near Pine Grove, Amador County, is being rehabilitated in preparation for operations. Following this work the company plans further sinking to permit additional development. C. L. Evans is superintendent.

WORTHINGTON

100 YEARS

1840 - 1940

"WHAT IS RIGHT WILL PROVE ITSELF RIGHT"

THUS WROTE Henry R. Worthington, a great engineer-inventor, in 1876. He continued, "I have asked for an answer to the question . . . Have I been able permanently to improve the department of engineering, in which I have steadily and exclusively worked?"

» Today, the company which he founded, its products in use in every country in the world, with plants that cover hundreds of acres, with the value of its manufactures reaching hundreds of millions of dollars, looks back over a century's span, and sees proved the essential soundness of its founder's vision and ideals.

» In its century of growth it has pioneered in many significant basic engineering developments of widespread application. Itself a pioneer, it has pushed forward shoulder to shoulder with pioneers, across continents and over the seven seas. It has witnessed the birth and growth of a new age. It has seen a whole new civilization develop, and has accepted the continued challenges of that civilization. Looking back on its rich and fruitful past, it turns to its second century confident of its ability to carry on with the splendid spirit and vision of its founder.

» Worthington's maturity finds expression in a notable group of engineering products with standards of excellence and records of performance unsurpassed in their respective fields . . . for the petroleum industry in production, transportation and refining . . . for gas and oil pipe lines and distribution . . . for refrigeration and air conditioning in every branch . . . for steam power, land and marine, including turbines, condensers, feedwater heaters and auxiliaries . . . feedwater heaters for railway locomotives . . . Diesel and gas engine units covering a wide power range . . . air and gas compressors for all industrial uses . . . a comprehensive line of contractor equipment . . . and pumping equipment whose scope is the most extensive available.

» It has been said that an institution is the lengthened shadow of a man. Perhaps more true of the Worthington Pump and Machinery Corporation than of most institutions, it yet is not the whole truth. This corporation is not only the lengthened shadow of one man, but of many men who have given the best of their keen minds and stout hearts, that their science and engineering could better serve not only their company but also the civilization of which they and it have been such important parts.

Harry G. Beaver

PRESIDENT

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY

Moore Steam Turbine Division . . . Carbondale Air Conditioning and Refrigeration Division
Worthington-Gamon Meter Company

M10-1

Production by the Manhattan Gold Dredging Company at Manhattan, Nev., comes from this large dredge that digs about 13,000 cu. yd. of gold bearing gravel per day

NEVADA

Molybdenum Deposits Being Prospected

Diamond drilling under way in Alum Gulch, Esmeralda County — Ohio-Eagle Mines, Inc., planning construction of a mill — Eldorado district in Clark County active

▶ A testing laboratory has been established at Goldfield by the Freeport Sulphur Company, which is prospecting, largely by diamond drilling, molybdenum deposits in Alum Gulch, southern Esmeralda County. Gordon A. Cain is chemical engineer in charge at Goldfield and A. A. Gustafson is directing mine work.

▶ Gold-silver ore is being shipped at the rate of 1,000 tons per month from the old Ohio mine, near Rebel Creek, in northern Humboldt County, by the Ohio-Eagle Mines, Inc. The ore, broken over a 20-ft. width near the surface, is trucked 60 miles to Winnemucca for rail shipment to a Utah smelter and is said to have given average returns of $15.95 per ton. Construction of a mill in the spring is planned. H. Alex Johnson is manager.

▶ Continued activity and expansion of mining operations in the Eldorado Mining district, Clark County has focused the attention of the State Highway Department on the subject of affording proper transportation facilities to the district early next spring. The three principal producing mines in this area are said to be the Techatticup, owned by the Diamond Gold Mining Company, P. A. Simon, president and general manager; the Eldorado Rover Mining Company, J. D. McPherson, manager, and the Wall Street Mines, owned by W. W. Hartman and managed by A. E. Place. The Techatticup mill employs cyanide and flotation, the Duncan mill of the Eldorado Rover Mining Company employs the cyanide process, and the plant of the Wall Street Mines is all-flotation. Nelson, Clark County, Nev. is the mail address.

▶ Lead-silver and zinc concentrates are being shipped with regularity from the lately completed selective flotation mill of the Rip Van Winkle Mining Company in the Merrimac district, 36 miles north of Elko, operated by a group that includes officers of the Utah Copper Company. S. Power Warren has been retained as metallurgist and mill superintendent and L. S. Breckon is manager.

▶ A 600-ton cyanide and sand leaching mill, completed lately by the Standard Cyaniding Company 6 miles from Rye Patch, in Pershing county, is operating at near capacity. H. L. Hazen, president and manager, citing features of the project, said the orebody is a mass of fractured, silicified limestone containing gold and silver ore, extending to a depth of only 230 ft. with around 1,070,000 tons developed by shafts and laterals. The mill crew on three shifts includes eighteen men, and costs are estimated at $1 per ton, including plant amortization. Employes receive a bonus based on mill-feed exceeding the rated tonnage. Pierce C. Walker is mill superintendent, with office at Lovelock, Nev.

▶ Dividend No. 13, at the rate of 5c. per share, was paid on Dec. 23 by the Getchell Mine, Inc., bringing disbursements in sixteen months to $720,000, or 48c. per share, on the 1,500,000 shares of no par value, all outstanding, of which Newmont Mining owns approximately 25 per cent. The enlarged ore-roasting plant is nearing completion, with a new 200x6-ft. steel stack and 260x7½-ft. rotary furnace, replacing the former 100x7-ft. kiln that will hereafter be used as a dryer. The new installation will give the adjoining cyanide mill a capacity of over 1,000 tons per day.

▶ Developing gold prospects that were discovered in May, the Comstock Gold Point Mines Company, with well-appointed camp and with compressors at two tunnels, has shipped some 200 tons of gold ore by truck to the McGill smelter from optioned claims in the Currant Creek district, northeastern Nye County. The lately organized Currant Creek Mining Company, under the same control, also has provided equipment and is shipping from a large outcrop on claims at the north. Charles M. Richardson is president of the Comstock Gold Point, which is operating near the California Mother lode. John N. Richardson is manager of both companies, with offices in Oakland, Calif., and at Ely, Nev.

▶ Bullion production of the Dayton Consolidated Mines Company in November was valued at $104,319.99, recovered from 5,427.55 tons of ore from the Dayton and leased Keystone-Justice mines, from leases, and from custom ore receipts. Near Silver City, Lyon County, the company operates its own 150-ton cyanide mill and the 90-ton Recovery flotation mill, leased from the South Comstock Gold Mines, Inc. Homer L. Gibson, managing director, said that operating profit for the final quarter of the current year will probably equal that for the first three quarters, amounting to $43,000. The company employs 130 men.

MONTANA

Mill Being Erected At Boaz Mine

Development during last two years warrants construction of plant to treat gold ores — Deep-level crosscut being rapidly advanced at Butte-Highland mine

▶ The Norris district continues to be one of the most active mining centers in the State, with the Boaz mine holding the most important position in terms of gold production. With a modest reopening of an old and nearly forgotten property, in a period of only a few years, the Boaz mine has gained an important place in Montana operations. Arthur J. Theis has been in charge during the last two years, in which time development has been extended to the 500 level. Milling facilities are now being installed.

▶ It is understood that the Hecla Mining Company, of Wallace, Idaho, has secured an option upon the Helene mine, which is not far from the Boaz.

▶ Production at the Butte Highland mine for November was valued at approximately $26,000. New, deep-level development, an 875-ft. crosscut, which is being driven parallel to diamond-drill hole No. 24, is being advanced as rapidly as possible. The drill-hole record indicates that a 30-ft. body of milling ore should be reached soon. A report that oxide ore has been found 40 ft. east of any known ore projections on the seventh level is interesting and the management believes this important. D. F. R. Fischer, who resigned from the board recently, has been replaced by H. D. Trunkey.

▶ The Timber Butte mill, formerly owned and operated by the Anaconda Copper Mining Company, was recently purchased by the Dulien Steel Products Inc., of Butte, Mont., which is now offering the equipment of this 1,000-ton plant for resale. The plant is said to have been closed in 1930 due to a duplication of equipment and processes of the Anaconda company at its plant in Anaconda, Mont.

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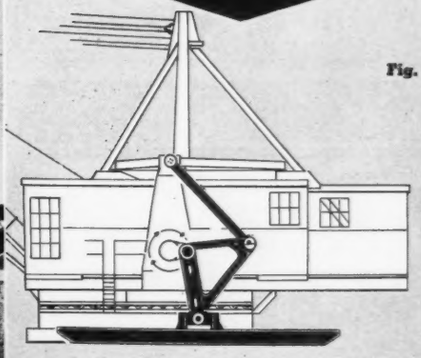

Fig. 1

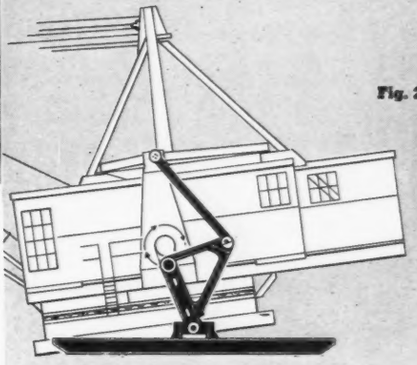

Fig. 2

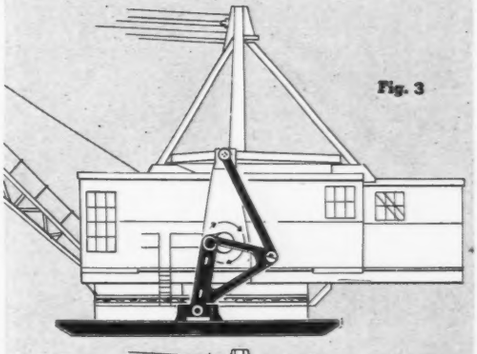

Fig. 3

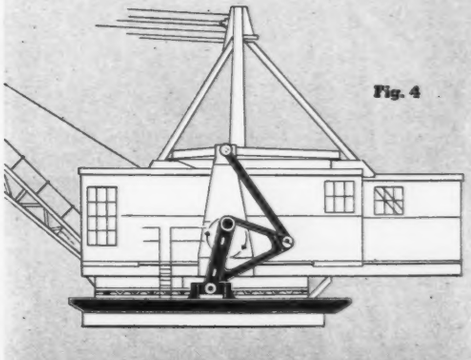

Fig. 4

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A.I.M.E. WILL CONVENE IN NEW YORK CITY

DURING Feb. 12 to 15 members of the American Institute of Mining and Metallurgical Engineers will convene in New York for their 152d meeting. Mining papers will cover diversified mining methods, equipment, and health and mine safety. Subjects on milling practices have been arranged to offer discussion on treatment of metallic ores and non-metallics.

THERE WILL BE a general session of the Institute at which two men of national prominence will speak. The annual banquet and dinner will be Feb. 14th at the Waldorf-Astoria.

ARIZONA

More Old Mines Being Rehabilitated

Properties containing copper and gold ores are being prepared for operation during 1940—Phelps Dodge Corporation will soon begin erection of large concentrator

▶ The old Shoestring tungsten mine, near Youngs, is being reopened by the Shoestring Mining Company, according to Jerry Brinkley, president of the company. About 1,000 tons of ore are now blocked out and a 10-ton plant is being installed.

▶ The St. Johns Gold & Copper Company, at Turkey, is building a new camp on the company's property and a 50-ton mill is to be installed soon. The company plans to deepen the main shaft, now down 452 ft. to the 500 level. A diamond drilling project is also under contemplation.

▶ The Double Eagle Mining Company is doing considerable work on a group of claims in Centenial, Wash., in southern Mohave County a few miles southerly from the McCracken mine. It has erected a small pilot mill. Paul Williams is in charge of the operations. He is associated with John Martell, an attorney of Santa Ana, Calif.

▶ Magma Copper Company, at Superior, has voted a year-end dividend of $2 a share on the common stock. This brings the dividends per share up to $2.75 for the year. The company paid $1.50 a share in 1938. William Koerner is general manager of the property.

▶ Tom Reed Gold Mines Company, operating at Oatman, has made application to the SEC to withdraw it's common stock from listing and registration on the Los Angeles and the San Francisco stock exchanges. The listing and registration has been unprofitable to the company, and with no increase in mine operations, the company made the decision to withdraw.

▶ The Hillside mine, at Hillside, is constructing a plant for the treatment of lead and molybdenum ores. O. O. Mattox, of 307 Blumenthal Building, El Paso, Tex., and associates are owners of the property. The Eagle-Picher Lead Company made an examination of the mine recently and is said to be assisting in the operation of the property under an agreement with the owners.

▶ The Rock Castle Mining Company is handling about 70 cu.yd. of gravel per hour on a one-shift basis at the Lynx Creek placers. A 1¼ cu.yd. Lorain shovel and a four-bowl Ainley machine with a diesel electric plant are used in the operations. Robert Black, of Prescott, is superintendent in charge.

▶ A. S. Lewis, of Cave Creek, is directing a development program at the old Maricopa mine, and recently opened up several shoots of gold ore. A ball mill, crusher and classifier are being added to the 25-ton mill installation. It is planned to run 24 hours daily.

▶ The Squaw Peak Copper Mining Company is driving a 2,000-ft. crosscut to cut the main vein at a depth of 580 ft. About 250 ft. more are required to strike the vein projection. Edison Thacker, of Camp Verde, is president of the company.

▶ The Leatherwood mine, in the Old Hat district near Oracle, is being operated by the Control Mines, Inc., which have recently taken over the property. Bob Burney, of Oracle, is manager. About 20 men are employed at present and about 80 tons are being produced daily. The property was formerly operated by the Catalina Consolidated Copper Company.

▶ The Phelps Dodge Corporation expects to complete its program for the removal of 37,000,000 tons of overburden from the Morenci open-pit mine early in 1941. Diesel power locomotives are scheduled for replacement soon after the first of the year of the trucks which have been engaged in hauling the waste. The 1,500-ton mill is operating steadily at near capacity and the flowsheets are being watched intently to determine the operations of the proposed 25,000-ton concentrator, work on which will commence in January, 1940. Ernest Wittenau is superintendent at Morenci.

▶ Leslie Saunders and associates have lately been examining the Bi-Metal mine, near Kingman. If the results are satisfactory, active operations are expected to begin shortly after Jan. 1.

▶ The A. E. Wagner, Trustee, a syndicate of New York and Connecticut capital, has recently taken over the Skookum group of claims in the River range about 20 miles northwest from Chloride, in Mohave County. The work is under the direction of R. Burton Rose, a geologist of Palo Alto, Calif., formerly with the New London Mines, of Colorado. H. Victor Burgard, of Hollywood, Calif., is consulting engineer.

▶ Construction of a refinery at Mammoth for the treating of diatomaceous earth is under way. Daily capacity will be 50 tons. Marian Staley, of Mammoth, is general manager of the company.

▶ The Arizona - California Exploration Company, operating the Pope mine, 20 mile northwest of Chloride, in Mohave County has been shipping ore steadily to the mill of the Producers, Inc., 6 miles west of Chloride. Recent underground development is said to have developed substantial ore reserves. If further disclosures are made as development progresses, the company plan the installation of a milling plant. A. W. Warner is manager.

▶ J. A. Gruwell, of Klondyke, general manager of the Grand Reef Mining Corporation, has completed the installation of a six-cell Kau flotation machine, and Dorr classifier, in the company's mill. Operations are expected to start soon.

▶ The Yucca Mines Corporation, which recently took over the Kampff properties, in the southern end of the Chimehevis Mountains in Mohave County, is installing a small mill and compressor. Camp buildings, and assay office, and other necessary structures have already been constructed and the company expects to begin production early in January. Roy Brown, vice-president of the company, is in charge of operations.

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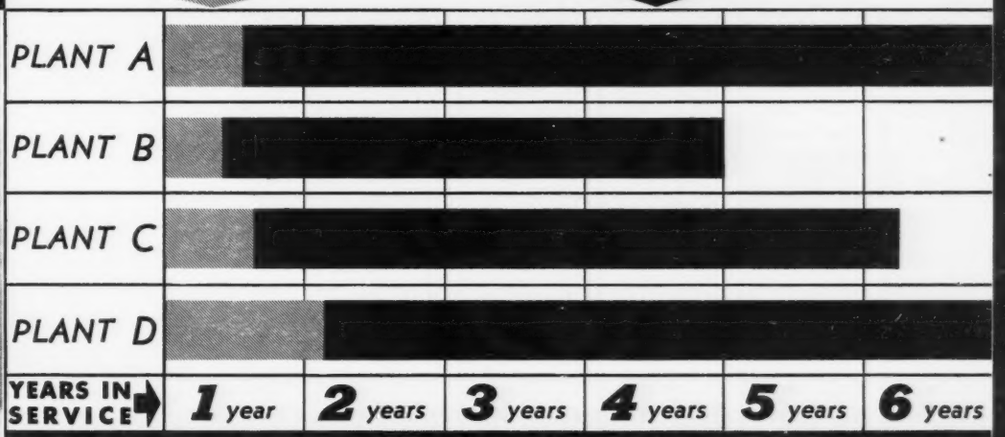

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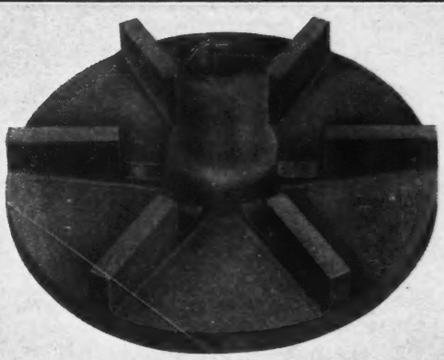

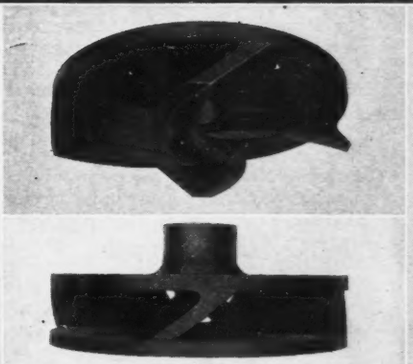

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NEWS FROM Washington

By Special Correspondent

RESIGNATION of Dr. John W. Finch as director of the Bureau of Mines was apparently requested by Secretary of Interior Ickes. The plan to have this matter kept confidential until January 31, the effective date planned, missed fire. A Washington columnist printed the story on December 30, alleging that the whole episode occurred on December 26.

Washington has expected changes in personnel in the Department of Interior for some time because of the growing strain between two factions in that Department. Dr. Finch is reported to be only number one on a list of those not sufficiently enthusiastic in New Deal ways, and, therefore scheduled for the purge.

Dr. Finch is charged with being too "gentlemanly" in his dealing with some of the staff members of the Bureau. The Secretary is said to have expressed a desire to use his remaining year in office to reorganize the parts of the Department of concern to the mining industry so that they will be more vigorously progressive. Dr. Finch is but one of the Departmental executives who has been at least cool, if not actually opposed, when certain reforms and changes in Departmental policy have been proposed.

Among the changes desired by Secretary Ickes, perhaps accounting for the present reorganization efforts, are the following items, which have been previously referred to in the columns of *E.&M.J.:*

1. Enactment of a new law to give the Department complete regulatory control of petroleum, in the interest of "conservation".

2. Enactment of a new law requiring the Bureau of Mines to make safety inspections of mines where accidents have occurred, and give the labor leaders, as well as the management, copies of reports rendered.

3. Use within the Department (or elsewhere) for *regulatory* purposes of confidential reports made by individual companies for the *statistical* work of the Bureau of Mines. (These reports were formerly confidential for use of the Bureau only, but are now confidential for the use of the Department of Interior.)

4. Modification of Bureau organization so that those more aggressively favoring New Deal reforms would be in charge. (Career men have preferred that the Bureau be an investigative fact-finding body without any regulatory authority.)

5. Support of certain domestic mining companies who desire to utilize the stock pile building program as a subsidy for domestic mines. Opponents argue that the bill was a preparedness measure not intended for either made-work relief or support of domestic politics in the mining states.

Part of the controversy on this last point depends on the degree of optimism which should be attached to discoveries of mineral reserves being made by the mining division, and new methods for ore processing evolved in the laboratories of the metallurgy division of the Bureau. Widely different interpretations have been prepared.

This matter of Departmental policy making has now gone so far that the mining industry is bound to hear numerous items of importance to it regardless of how Secretary Ickes proceeds in his handling of the post of the director of the Bureau of Mines.

Politics and Mining

THE President and his Cabinet appear late in December to be irrevocably committed to the support of the Hull trade agreement program. Even Secretary of Agriculture Wallace has been enlisted as a supporter, despite the obvious hazard to him of bitter criticism by agriculture. This means more than ever that the New Deal intends to carry on with tariff cutting and that there will be no retreat with respect to zinc (Canadian agreement) or on the numerous other metal and mineral commodities of less importance to the industry as a whole, but still vital to the subdivisions of mining that are directly concerned.

Leaders in the Senate who have not welcomed the new prominence of Mr. Wallace may be able to hold their lines in what is known as the "mining state bloc." So long as that group votes as a unit, it can muster sufficient support to defeat any new legislation. It can, therefore, defeat the proposal to extend the trade agreement authority beyond next June. It can also stop most other new reform measures which might be of deep concern to minerals and mining.

But this bloc is not powerful enough alone to put through new legislation which it wants. This is true for two reasons: First, it has no counterpart in the House of Representatives where the number of mining state Congressmen is not great nor is the group closely knit. Second, it is much easier to organize dissimilar factions into a coalition for *defeat* of anything than it is to organize for *support* of a new measure. People who are opponents for varying motives still vote together. It is not so easy to organize a supporting group which has varying interest or purpose.

Secretary Hull on Dec. 21 announced that no tariff cut would be made on copper or copper products in the Chilean agreement. This precedent-breaking action proves that even he had become terrified by the rapidly mounting opposition to the trade agreement program. Whether his change in policy on copper will save this legislation from defeat depends more on the sort of a "deal" that had to be made in order to get this copper action than it does on the judgment of the members of the Senate. Only time can disclose whether this Washington negotiation has broken the mining bloc solidity with reference to the trade-agreement program.

All this means that the mining industry has a buffer against new attack, but neither secure defense against continued embarrassment from New Deal administration of existing legislation, nor opportunity to secure relief from present burdensome law in such cases as the Wage-Hour Act or NLRB findings.

Facts vs. Hopes

TECHNICAL achievements of research by the Bureau of Mines have been given considerable publicity in Washington, especially as a result of the annual report of the Director. The reaction has been both complimentary and critical. The compliment is for the achievement. The criticism is addressed at the interpretation given.

Unquestionably, over-optimistic interpretations have occurred. As a consequence, some promoters representing domestic mining interests have sought to use the Bureau's laboratory results as an argument for limiting strategic-materials purchases to the output of United States mines. There is some fear that this may defeat the whole stockpile program.

Only the President can settle the issue. Arguments that will be presented to him are simple, but translating these arguments into a Federal policy will not be easy. The issue is clearly between preparedness and employment politics.

It remains to be seen whether the President will feel that the stockpile buying program should be speeded up. He is being urged to ask Congress to give authority for immediate commitment of the entire remaining $90,000,000. If such authority is given effective the first of July (when such appropriations normally become available), that would not mean necessarily completion of all deliveries within the fiscal year, but it would permit long-term contracting for the supplies. Advocates of this plan feel that the greatest economy and the greatest certainty of preparedness can be accomplished only by such early purchasing arrangements.

Capital Skirmishes

NOT ALL THE FIGHTING is being done in Europe and China. A continuous guerilla warfare having importance for almost every division of mining continues in Washington. Even that part which is political has economic meaning. Recent skirmishes, the meaning of which should be noted, include:

1. *Embargo* on German goods by Britain is protested by Secretary Hull, but business should not expect that the State Department can very much ease their difficulty in moving mineral, metal, or other commodity through the British blockade.

2. *The power "grid"* hook-up proposed by Secretary Ickes and his power planners has run smack into the theories of the Chamber of Commerce of the United

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States. If wishes were billions, the planners would win. But Congress is not in a mood to grant funds for the new power plan. Western mining may, however, experience a backwash from this controversy in the new effort to place surplus power from Government hydro projects in important new areas. Congress might furnish some money for that, or some of the loan agencies may advance it, on the ground of salvaging income from otherwise idle power investment.

3. *Budget balancing* is not likely despite the Taft challenge quoting the President's 1932 theories. Even if those were then (and are now) sound, they will not be applied in an election year. It is less dangerous to raise taxes than to cut budgets heavily.

4. *Third term* talk may or may not be significant. But no experienced Washington observer would expect the President to eliminate himself until after most of the present Congressional session. If he did so, he would lose what little control of Congress he now has.

5. *Patents* as an element of monopoly building are under a double-barreled attack by the Department of Justice. The crackdown on the glass industry which takes the form of a civil suit in Toledo is significant of only one type of patent control criticized. There will be numerous other forms of patent management aired in an unpleasant fashion in the New York City grand jury proceedings from which Justice expects a flock of significant indictments.

6. *Monopoly by labor* organizations continues under the fire of Attorney General Murphy and his whole staff. The displeasure of both major union groups has not caused any retraction from the original statement of policy. Antitrust statutes will be undertaken if necessary as a labor-trust-busting program.

7. *Un-American activities* as disclosed by the Dies committee have enough popular appeal, judging from polls of general sentiment, that cutting them off will be embarrassing politically. The showmanship of Dies has developed a situation far more significant than the more thorough digging of numerous other investigative committees. Washington responds to emotion, not to reason.

Controlled Metal Exports

"CONGRESS will enact legislation early in 1940 to require license on all exports of important metals to Japan." And many other things than metals "may require license before they may be sold to this Oriental aggressor nation." This is substantially the categorical forecast of one of the keenest Washington analysts of mineral economics. But it must be understood that the forecast is based on certain assumptions as to the indignation of Congressmen regarding Sino-Japanese affairs.

It does not appear likely that so sweeping a restriction on goods movements will be imposed in 1940. But it does seem likely that restriction on iron and steel scrap export may be required under terms far more drastic than are now imposed by the State Department under the Presidential authority. The obvious purpose will be to weaken Japan's position in the metal industries. Because of this idea there is serious talk about Washington that licenses should be required for *all* of the metals and minerals which are *for Japan* strategic. Such list would obviously be significantly different in detail than the United States strategics list.

"Moral embargo," which has prevailed regarding arms, ammunition, and implements of war, was last month extended to certain commodities. Washington is now asking American manufacturers and exporters to withhold sale of aluminum, molybdenum, and aviation gasoline. Japan and Russia are not to get these goods, if the Administration has its way, being selected because they bomb indiscriminately over civilian territory not primarily of military significance. This obviously is a novel definition of "neutrality." But apparently it works, as moral suasion in these matters is almost as good as legal requirement when it comes to influencing manufacturers and exporters. They do not dare disobey such requests.

At the present time tin-plate scrap export is regulated by a new set of rules published in the Federal Register on Dec. 7 by National Munitions Control Board. Those seeking to arrange exports will find in that publication details regarding licenses and terms of permissible shipment.

Tin Bids by Brands

UNCLE SAM became a realistic business man during December. He decided to buy tin as other folks do, that is by brand name. This development in the stockpile program will, it is hoped, enable the Government purchases to be a constructive influence, not a disturbing factor, in the market.

Under earlier purchases previously reported by *E.&M.J.*, bidders were required to meet definite composition specifications. It proved impractical to draft such limits on analysis in a way that would not make abnormal competitive relations between different brands of tin widely recognized in the market. The bids opened on Dec. 20 were therefore strikingly different in significance. They permitted the customary trade specification of a brand, of course with guarantee to meet typical analysis. ***BUT***, they also permitted those producers who have not yet established brand characteristics also to bid on the basis of guaranteed analyses. Thus even the new domestic producers could, if they chose, make offers despite the fact they had not yet established a quality specification by long operation comparable in significance with those for "Straits," "Banka," etc.

The result of this policy delighted the stockpile builders. Five purchases were made for tin from the Middle East and one small lot of 100 tons of metal was made from Bolivian ore. The aggregate of the five contracts was a purchase of 6,560,000 lb. at an aggregate price of $3,132,000. The only offerings rejected were those above 48.25c. and even those higher offerings might have been accepted if the funds immediately available for commitment on tin had not been exhausted by these and previous purchases.

Delivery on all contracts is expected during the first six months of 1940. Some delivery early in the year was hoped for, but to avoid excessive pressure on immediate supplies, the Government is consenting to have much of the delivery made in the second quarter of the year.

News "Fines"

Mobilization—The official résumé of the Industrial Mobilization Plan has been published by joint action of the War and Navy Departments. Industries concerned can get the general background program, essentially the emergency organization chart now proposed in this revision of 1939, as a 10c pamphlet from the Superintendent of Documents, Washington, D. C. But the pamphlet is silent on who would operate the plan. Washington knows, however, that the Stettinius committee will probably not return for that purpose.

More Manganese Bids—Manganese ore bids opened Dec. 19 disappointed government officials. Eight domestic companies and five foreign-ore firms made offerings. But the only two (one domestic and one foreign) which offered to give a bond for performance of the contract were high bidders. Purchasing by negotiation of foreign ore will probably be necessary if any substantial tonnage is obtained at reasonable prices. Rejection of all present bids is likely as a preliminary to such negotiations. Late in December the Treasury Department had not yet completed arrangements for final signing of the contract with Greenbrier Mining Corporation, for which an award was arranged as a result of earlier manganese offerings.

A Permanent TNEC?—Advocates of further Federal study of business economics are asking that TNEC be continued. If they cannot have that joint agency of Congress and the executive departments, they would like at least to have a new Bureau of Industrial Economics. The trouble with the latter idea is that Commerce, Federal Trade, and Justice all would like to boss such new executive agency.

No Labor Law Changes—The faulty administration of NLRB in its early years is being frankly presented. Advocates of that law realize that any attempt to cover up would be dangerous. They apparently hope that a reform in administration, possibly the naming of a new Board with more conservative membership, will make any radical change in the fundamental act unnecessary this year. All members of Congress would be glad to be excused from voting either for or against such changes just before election, for any such vote would displease somebody.

Tin Contract—The Procurement Division of the Treasury awarded contracts on Dec. 21 for a total of 6,560,000 lb. of tin under the provisions of the Strategic Materials Act. The awards follow:

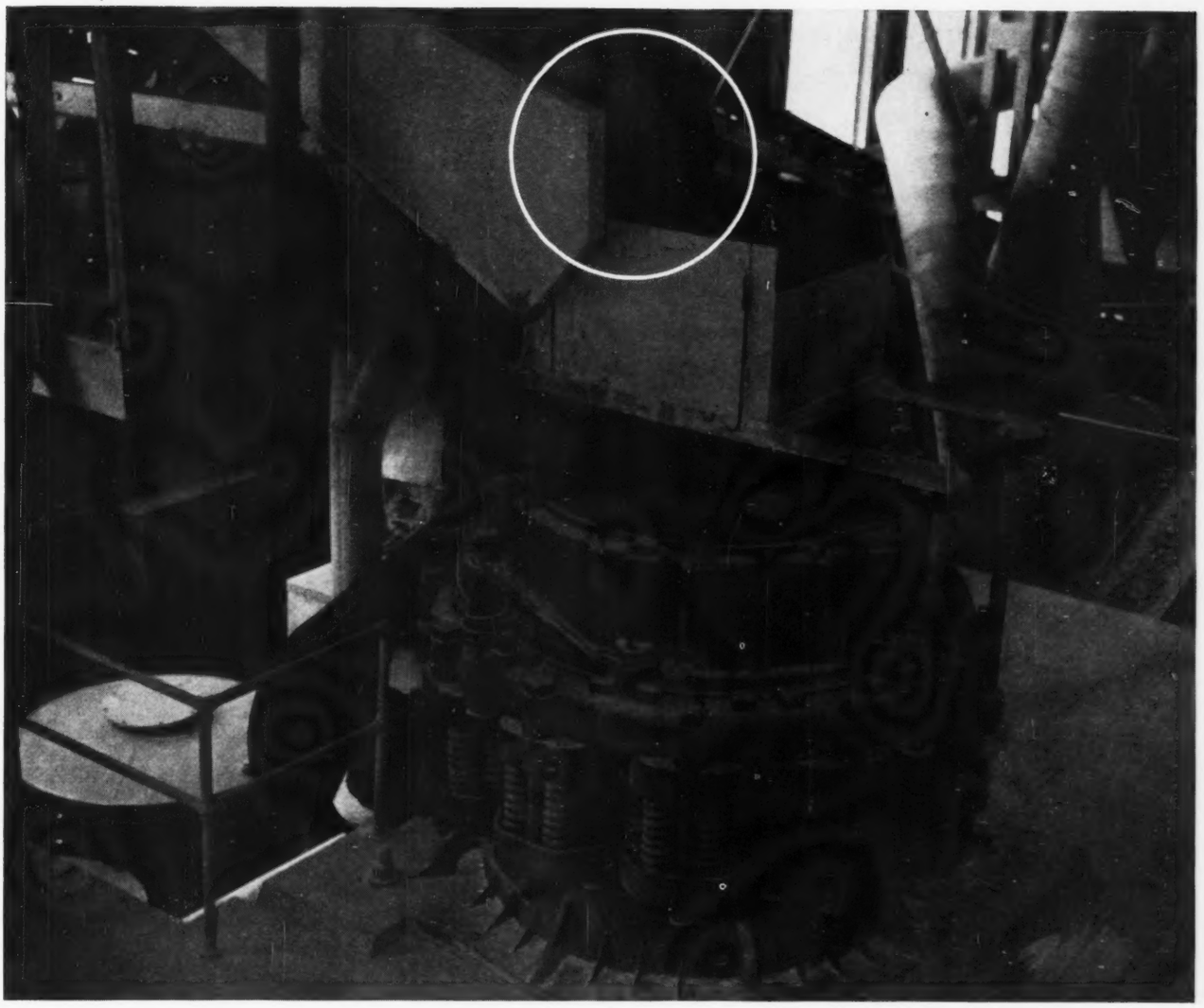
C. S. Trench & Company, New York, Straits tin, 2,000,000 lb., at 47.44c. per pound.

Caswell, Strauss & Company, New York, Netherlands East Indies tin, 2,240,000 lb., at 47.61c. per pound.

Metal Traders, Inc., New York, Straits tin, 1,120,000 lb., at 48.29c. per pound.

Domestic & Foreign Commerce Corporation, Washington, D. C., Netherlands East Indies and Straits tin, 1,000,000 lb., at 48.25c. per pound.

American Metal Company, New York, Bolivian tin, 200,000 lb., at 47.22c. per pound.



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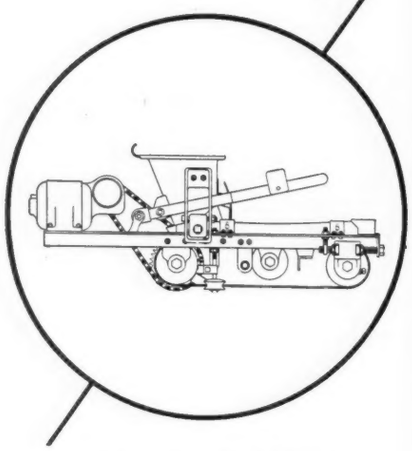

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WASHINGTON

Northwest Magnesite Company Increases Production

Mine at Chewelah recently put its fifth kiln into operation—Small lead mines prepare for active 1940 schedules

▶ Northwest Magnesite Company, at Chewelah has put into operation its fifth kiln, raising its capacity to maximum and employing 450 men. Before the European war started, 250 men were employed. The increased demand for the product comes not only from Eastern steel manufacturers but from Mexico and South America, according to E. A. Garber, manager. This company has the largest payroll in Stevens County and except for the Howe Sound enterprise it has the largest mining payroll in Washington.

▶ Electric Point, in northern Stevens County, is being operated by nine leasers who shipped 100 tons of high-grade lead ore in November to the Bunker Hill & Sullivan smelter in Idaho. Arthur Simonton, of Leadville, Wash., is the owner.

▶ O. P. Wiltermood resumed operations with his 25-ton mill at the Silver Trail mine, 26 miles from Colville, in December. He is milling ore that runs 6 per cent lead and 12 oz. of silver to the ton.

▶ Ben Welby is working the Rock Creek mine, in that district, on which there is a 40-ton mill. He is sorting and shipping 200-oz. silver ore which carries a little gold.

▶ O. K. Quast, William Dohmer, and Arvid Anderson have leased the Double Eagle mine, 12 miles west of Valley, and are trucking to the Tacoma smelter ore that is said to carry 70 oz. of silver and 22 per cent lead to the ton.

▶ Good lead ore, 12 ft. wide, has been opened by Ben Hofer, of Northport, on the property of Bechtol, half a mile east of Deer Lake, in northern Stevens County.

▶ A new body of lead ore of a good grade and 4 ft. wide has been struck in the Red Top mine, at a point in the tunnel 2,300 ft. from the portal and 700 ft. below the surface. The property is in the northern part of Sevens County. J. Richard Brown, of Spokane, is engineer in charge.

▶ Deertrail Monitor Mines Company, near the Germania, put its mill on a three-shift basis in December, handling 30 tons of molybdenum ore a day and producing approximately 750 lb. of concentrates carrying 70 per cent MoS_2.

▶ Thomas G. Stevens, of Colville, lessee of the Old Dominion mine, in Stevens County, is shipping silver-lead ore. Old Dominion, the oldest mine of importance in the county, has been idle many years.

▶ James W. Gerard, of New York, former Ambassador of the United States to Germany, and associates, have acquired the Valley Gold mine, 7 miles north of Republic. Ira Hoagland and his son Everett Hoagland, a mining engineer, obtained this property by tax deed and developed it into a producer. The Gerard interests have obtained the property from the Hoaglands.

▶ George Turner, president of Ruby Mountain Mining Company, reports that the company has shipped several truckloads to the Tacoma smelter, the concentrates carrying 150 to 200 oz. of silver to the ton. The property is in the Conconully district of Okanogan County.

▶ Rapid Milling & Smelting Company, at Oroville, began operations in the fall, before its plant was entirely under a roof. It is a custom plant and began by treating ore from the Ivanhoe mine, on Palmer Mountain. Carl Lundstrom, of Electric City, is in charge.

▶ Washington Graphite & Metal Company is installing a 50-ton mill to treat ore from its molybdenum mine, near Moses Meadows, in Okanogan County. The equipment includes a crusher, classifier, and flotation. J. R. Laycock will be in charge, according to a report from Omak.

▶ The Aluminum Company of America has announced that it has signed a 20-year contract with the Bonneville Power Administrator for a substantial block of power to be utilized in the production of aluminum in a plant to be constructed near Vancouver, Wash. The new plant will produce 30,000,000 lb. of aluminum annually, and, combined with the company's four existing plants, will bring its total capacity to more than 400,000,000 lb. a year. The plant is to be completed in about a year.

OREGON

New Hydraulic Gold Operations Scheduled

Preparations for work were made during 1939 near Grande Ronde River—Bonanza Mines Company increases quicksilver output

▶ Carson Channel Gold Syndicate, Inc., spent the entire 1939 season preparing for hydraulic operations at its property on the headwater of Grande Ronde River, 40 miles south of LaGrande, and expects to go into production with the resumption of operations about Feb. 1 or as soon thereafter as winter conditions will permit. During the summer, ditches, flumes, pipe lines, and penstocks were built. Harry Howell, a hydraulic mining engineer, was in charge during the first part of the season, after which E. J. Mimnaugh, of Spokane, Wash., an experienced operator and president of the company, took charge. The deposit is at an altitude from 4,000 to 5,000 ft. in the Blue Mountains. William P. White, mining engineer, has estimated 7,000,000 yd. of available gravel with a possible return of 40c. a yard. The company claims operating costs will be approximately 5c. a cubic yard.

▶ Bonanza Mines Company is a steady producer of quicksilver at the property

in Douglas County, which it holds under a ten year lease from the State. It increased its output during the season, and in November is reported to have been producing ten to twelve flasks a day. The property has now been equipped with a Gould rotary furnace, which is expected to further increase production. H. C. Wilmot is engineer in charge, with 25 men employed. S. R. Smith and Norman Whittall, of Vancouver, B. C., are associated with the enterprise.

▶ Cornucopia Gold Mines, Inc., is said to have grown into the largest mining operation in Oregon, with Leverett Davis, manager. He is vice-president of Oregon Mining Association. The property has the largest underground workings in the State. Cornucopia is near Baker, Oregon, in the northeastern part of the State. The office is 1411 Fourth Ave., Seattle, Washington.

IDAHO

Federal Mining and Smelting Buys Claim

Property adjoining Morning mine is acquired — Mines report higher production for 1939 — Tungsten producer plans expansion of mill

▶ Federal Mining & Smelting Company has purchased the Fanny Gremm claim, adjoining the Morning mine at Mullan, for a reported $50,000, according to officials of the Gremm company. Development work will probably be from the 2,400 level of the Morning shaft.

▶ Coeur d'Alene district mines paid shareholders dividends of $6,991,074 in 1939, or $3,021,136 in excess of 1938 dividend payments. Increased earnings are attributed to better metal prices for lead, silver, and zinc. This year's dividends bring the total payment record of the Bunker Hill, Federal, Hecla, Polaris, Jack Waite, and Sunshine to $123,220,064. Six mines in the district resumed or started production during the year, the Star, Coeur d'Alene Mines, Silver Dollar, Tamarack, Sherman, and Dayrock.

▶ Ima Mine Corporation, Patterson, Idaho's largest tungsten producer, will install new machinery to double capacity or turn out 40 tons of tungsten 65% WO_3 per month, besides 200 tons of concentrates. 20 men will be added to the payroll, bringing the employees to 100. W. P. Barton is general manager and Owen Hickey, superintendent, at the mine.

▶ A complete milling plant, including a crusher, flotation and other essential units to treat ore, that can be mounted on an ordinary truck and treat up to 40 tons of ore per day, has been designed by R. S. Handy, superintendent of the Bunker Hill & Sullivan mills at Kellogg. The unit has a cleaner, a filter, and separate sections for making lead, silver, or gold concentrates. Power is supplied by a gas or diesel engine. About 500 lb. of ore can be put through in five minutes, or up to 35 or 40 tons daily. Small mines and prospects of

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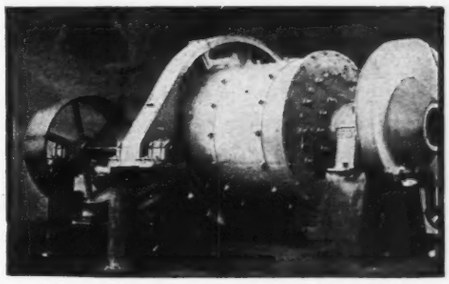

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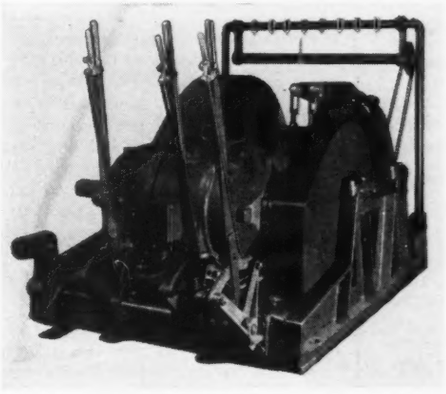

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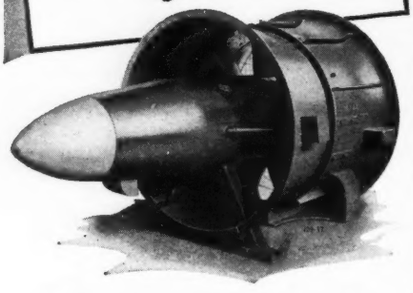

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IDAHO

the Coeur d'Alene district are showing much interest in the new portable mill.

▶ Rainbow Mining Company, Medimont, is driving a raise to intersect a diamond-drill hole where the core disclosed 10 ft. of milling ore, 11 per cent lead and 8 oz. silver to the ton. George Austin is president and manager.

▶ The McIntosh gold mine, on Bear Creek, in Idaho County, is being opened by Ernest Schmidt, of Leland, Idaho, who is installing a new-design 25-ton milling plant manufactured by the Union Ironworks of Spokane.

▶ The Yellow Jacket mine, Lemhi County, west of Forney, operated by the Condor Mining Company, has closed operations for the winter, freezing weather stopping the water power. About 25 men have been employed.

▶ Silver Cable property, on the Montana divide east of Mullan, has been leased to the Walla Walla Leasing & Development Company, formed by George H. McKinnis, Kellogg; H. H. Miller, Wallace; and O. A. Harmon, Walla Walla. The lead-zinc ore will be hauled to a local custom mill.

▶ Teton Phosphate Company, Inc., has been organized to develop phosphate fields in southeastern Idaho, near Bennington. Incorporators are H. T. Hitt, of Hammett; C. Van Clark, Boise; F. P. Van Hook, Boise; Milton Robison and Conover Wright, Montpelier; Frank D. Maxwell, Eagle; J. B. McKinley, Boise; and Edward G. Rosenheim, Boise, attorney for the company.

▶ The Lucky Friday company, Mullan, has completed a shaft to a depth of 100 feet and crosscut to the vein where two feet of ore showed returns of 33.3 oz. silver, 2.5 per cent lead and 6.5 per cent zinc. The shaft will be continued another 100 feet.

▶ Walla Walla, Wash., residents have incorporated the Juno-Bob Mining Company and plan to open a large open-pit mine in Idaho at Kelley Bar, on the Salmon River. A prospecting mill of 15 tons' daily capacity is being installed. Steam shovels will be operated from a dike vein which is reported to carry $5 per ton in gold values. Company officers are Dr. W. G. Cowan, president; L. L. Barrett, vice-president; and Dr. G. G. Schneller, secretary-treasurer, all of Walla Walla.

▶ A full face of copper ore has been reported opened by the Cossack Tunnel Company in its property near Mackay. Assays show from 6 to 12 per cent copper. The property has been idle for many years. Approximately 50 leasers are working in the upper levels of the Cossack tunnel.

▶ Salt Lake men, headed by Ben C. Rich, plan to operate the old Silver King mine in the Sawtooth district, 50 miles north of Sun Valley, Idaho. The Crown Consolidated Mines, Inc., has been organized to operate the mine. George B. Guillotte, company engineer, will remain at the property this winter with a crew of two men to unwater the shaft and put the mine in condition for operation next spring. The property is equipped with a flotation mill, a 500-ft. shaft, a surface plant, boarding and bunk houses, blacksmith shop, and assay office.

▶ The Talache Mines, Inc., of Boise, has acquired the Monarch mines and will operate this gold and silver property in conjunction with its Boise-Rochester mine at Atlanta, according to A. H. Burroughs, Jr., Boise, president-manager.

UTAH

New Park Mining Strikes Good Ore

Long Mayflower tunnel finally reaches its objective and development of vein so far is encouraging—Exploration at Horn Silver mine indicates larger or reserve possibilities

▶ Ore discoveries in the East Park City and the Ophir districts have added fresh interest to prospecting in Utah. After more than ten years, the Mayflower tunnel of the New Park Mining Company has reached one of its principal objectives and has shipped several carloads. The Ophir district development occurred in the Ophir Queen lease of C. S. Lynch and R. A. Glenny, in Dry Canyon. At a distance of 7,000 ft. from the portal of the Mayflower tunnel, W. H. H. Cranmer, president of the New Park Mining Company reports a 11-ft. east-west fissure was struck. Ore in the fissure varied from 2 to 3 ft. wide for a distance of 45 ft. Three carloads shipped netted the company $400 a carload. In a drift east of the point, where first struck, the ore persists. A raise put up on the fissure is yielding a higher grade of ore. Samples assay 0.18 to 0.36 oz. gold, 21 to 50 oz. silver to the ton and 4 to 18 per cent lead. The orebody, Mr. Cranmer, says, is not one previously prospected in the upper Park Galena property.

▶ The Horn Silver mine of the Tintic Lead Company in Beaver County, reports shipments averaging 60 tons daily. Fifty-seven men are employed under the direction of Carl Haney, superintendent. The shaft has been repaired to the 500 level and two compartments, have been put in condition for operations. Exploration in the limestone, 125 ft. west of the trachyte-limestone contact producing most of the ore in the past, has opened up large ore reserves. Company officials estimate that 50,000 tons of siliceous ore having a net value of $10 a ton, and 30,000 tons of silver-lead ore carrying a value of $30 a ton at the smelter, have been developed.

▶ The Lynch-Glenny strike has been made in the south end of the Ophir Queen ground in the Madison limestone. An incline shaft, D. H. Vincent, president of the Ophir Queen, reports, followed ore for 300 ft. Crosscuts east and west on a northeast-southwest fissure system show the ore to be extending on both sides. The ore is said to average $30 a ton in lead and silver,

with gold values ranging from $3 to $7.50 a ton. The leasers have installed a larger compressor and drilling equipment to increase production from 25 to 40 tons daily.

▶ Under contract with the Ophir Queen Company, the Madison Mines Company, according to N. G. Morgan, manager, is driving a west drift from the 150-ft. level of its shaft to reach the ore-bearing limestones in the north end of Ophir Queen ground. The west drift, it is reported, which is nearing the orebearing limestone along the strike of the fissure making ore to the south, has already entered a mineralized formation, Mr. Morgan reports.

▶ Another Beaver County property, the Harrington-Hickory in the Star district, 5 miles west, of Milford, is shipping ore. E. C. Barton, president of the New Majestic Mining Company, 309 Atlas Building, Salt Lake City, which is operating the mine, recently shipped 30 tons averaging $14 a ton in silver, lead and zinc. Leasers are also operating in the old Moscow Silver property.

▶ The Alta Helena tunnel, in the South Fork of Little Cottonwood Canyon near Alta, 25 miles from Salt Lake City, is nearing at a point 1,100 ft. from the portal a fissure showing ore in the upper workings.

COLORADO

Metal Output Will Show Increase for 1939

Higher prices for silver and base metals encourge operators to view outlook for 1940 as satisfactory—Carleton Tunnel is 20 per cent completed

▶ The Colorado mines and the Golden Cycle mill, at Colorado Springs, shipped $7,900,000 of gold and silver to the Denver mint during 1939. Of this amount only $69,000 was silver, the rest being gold. A number of Colorado counties have shown an increase in the amount of gold shipped: Ouray had a considerable increase over 1938, as did Park County, Rio Grande County, San Miguel County, Lake County, Gunnison County, and Boulder County.

▶ The drainage tunnel at Cripple Creek, under the direction of Alfred Bebee is in about 6,700-ft., and driving at the rate of 300 to 350 ft. weekly. Completion of the first mile driven was celebrated at Colorado Springs on Dec. 2 by Colorado mining men. The monthly figures since the contract began in July, 1939, follows:

July, 345 ft.
August, 1,201 ft., average 39.7 ft. daily.
September, 1,367 ft., average 48.8 ft. daily.
October, 1,534 ft., average 49.5 ft. daily.
November, 1,474 ft., average 49.1 ft. daily.

Superintendent Austin and his crew have broken all world's records for tunnel driving; and the present actual rate of driving may tap the main flow of water in about two years. Twenty per cent of the actual length is now completed.

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HIGH STEARNS DUTY

▶COLORADO

gold ore piercing the lime barrier into unexplored ground at the American Nettie mine, Ouray, Colorado, Messrs. McCullough and Withrow have installed a hoist and are sinking on the vein. For the past year they have been working on a streak of high-grade ore, expecting the vain to chop off abruptly at the lime; but contrary to former showings it continued through and has held unbroken. This showing has held much interest and the possibilities are considered to merit real exploration work.

▶ Guy V. L. Emerson, president of the Treasure Mountain Gold Mining Company, recently visited the property, at Silverton, and approved the contract for winter operations. This work will consist of extending the Sandiago tunnel some 800-ft. to a point under the Golden Fleece property. The same group of men—namely, Frank Nelson, L. L. Richards, and Wm. Moreau—who are putting the Alta crosscut from Blackhawk to the St. Louis, are contractors on the new work.

▶ The Gold Mines Consolidated, owners of the Donna Juanita group of claims in the Idaho Springs district, have taken a lease and option on the Gustafson mill, which they have overhauled, and are now treating ore on a two-shift basis. The Gold Mines Consolidated, Inc., also own the Bruce properties in the Cascade district, the Egyptian group on Quartz Hill, and the War Eagle group near Rollinsville.

▶ Jack Stevens, trustee of the Ute Creek Syndicate, has started operation of the M&M tunnel on Ute Creek. Stevens plans to continue the tunnel towards the Dixie vein, as he recently secured a lease on a portion of same from W. W. James and associates.

▶ The famous Melvina, in the Boulder section, is being operated under bond and lease by H. M. Gregory. The property consists of six claims that have lain idle since 1921. The shaft which was completely caved in for several hundred feet has been retimbered. Mr. Gregory expects to unwater from the 300-ft. level to the 750-ft. level. The mine has a 100-hp. Cummings diesel, a 310-cu.ft. two-stage compressor, and Delco lighting system.

▶ Clayton Kissel and company have completed 1,000 ft. of development work on the B&M property, in the Boulder Territory. They have acquired the Strong mill, which is treating both dump and mine ore.

▶ S. F. Wright, who took a lease on the Emancipation mine in 1938, has been shipping some good ore. Dump ore is being hand-sorted.

▶ The Rawley Mine & Smelter Company plans to move the 50-ton smelter from Ouray to the Bonanza region, near Salida. It expects to handle ores from other mines in the district in addition to ore from the Rawley mine. John McDonald is president and general manager.

▶ The Alma Lincoln Mining Company, Idaho Springs recently declared a dividend of ½c. per share on approximately 2,000,000 shares of stock outstanding, payable Dec. 15 to stock on record Dec. 5. Total disbursements for 1939 were 2c. per share. The company has been maintaining steady operations since 1933. A quarter interest was recently purchased in the Silver Spruce Gold Mining Company, which has recently completed a 75-ton flotation plant near Idaho Springs. Officers of the Alma Lincoln Mining Company are Clyde M. Lyon, president; Count Harvey, vice-president; and George M. Donnelly secretary-treasurer.

TRI-STATE

Wages Drop as Zinc Price Suddenly Declines

Holiday shutdown may be longer than first planned because of market uncertainty—Milling operations at the Bird Dog plant suspended indefinitely

▶ The apparent causes of the recent drop in zinc concentrate prices from $44 to $39 per ton early in December has thrown the Tri-State mining industry in to a state of confusion. Many operations were just brought up to capacity production and are now faced with an extremely apathetic market for their product. Just what the outcome will be after the first of the year is in doubt, but it is pretty certain that the holiday shutdown will be longer than anticipated. It is rather a blow to the miners to have their wages reduced 50c. per day just before the holiday season. The district received another jolt on Dec. 29 when the price of zinc declined from 6 to 5¾c., St. Louis, thereby again lowering the price of zinc concentrates to $37.50 on Jan. 6.

▶ Eagle-Picher Mining & Smelting Company has placed its company-operated mines on a five-day week, but the Central mill will continue on a six-day week. Ore formerly milled over the Bird Dog mill of the company will receive primary crushing and sampling at the Bird Dog mill and then will be transported to the Central mill for treatment. Operations at the Bird Dog mill will be suspended for an indefinite period.

▶ C. H. Blackburn, of Joplin, is building a derrick over the shaft of the old Eureka mine, about two miles north of Galena, Kan. The mine, which has not operated for 35 years, was last mined on the 302-ft. level. A 6-inch Pomona turbine pump is being installed and mining will be started on the 240-ft. level while the water is being lowered to the 302-ft. level. Blackburn has recently unwatered a shaft on the Van Haften land near Bellville, Mo., and is mining a good run of ore on the 75-ft. level. The ore is trucked about 6 miles to the mill of the Peacock Mining Company, in the old Peacock mining camp in Kansas.

▶ Charles A. Neal, of Miami, Okla., has announced the capitalization of a new tailings re-treatment enterprise, the Western Mining & Milling Company, with Charles A. Neal as president, S. L.

Kenney, of Miami, as secretary-treasurer and H. H. Hartzell, of Baxter Springs, as general manager in charge of operations. The company has purchased the Anna Beaver tailings re-treatment mill from the Eagle-Picher Mining & Smelting Company. This mill, built by the Commerce Mining & Royalty Company in 1937, has a capacity of 125 tons per hour, and is one of the largest re-treatment mills in the district. Tailings from the Jack & Jill and the Kitty No. 2 piles about one-half mile west of the mill will be treated first. About 70 men will be employed.

IRON COUNTRY

Shipments for Season Reach 45,072,724 Tons

Outlook for operations during 1940 appear bright — More trucks to haul ore replacing locomotives and dump cars

▶ Official Lake Superior iron ore shipments for 1939 season were 45,072,724 tons. This includes 70,639 tons from Canada. On Nov. 1, a balance of approximately 39,000,000 tons was on hand at Lake Erie docks and furnace yards. Shipments for November totaled 5,477,969 tons, so that the balance on hand Dec. 1, was 40,732,096 tons. Provided furnace operations continue at anywhere near the present mark, the balance on hand May 1 should run between 15,000,000 and 20,000,000 tons and put the iron-ore industry in a very healthy position to commence the 1940 season.

▶ Practically every mining company is employing a large force on stripping operations and repairing. With the adoption of trucks in virtually all operations, which is expected to increase from now on, more skilled labor will be employed. During the 1940 season several of the independent operators will use trucks in all mining operations, and this is a great departure from the old method of mining with locomotives and dump cars.

▶ The Canisteo mine, at Coleraine, Minn., will continue stripping practically through the winter months; the Hill-Trumbull mine, at Marble, Minn., will continue stripping until late in January and the Holman-Cliffs mine. Taconite, Minn., is stripping and will continue to run into January also. Water in the Holman-Cliffs mine is being pumped out for 1940 production.

▶ Butler Brothers' operations at Cooley, Minn., are now discontinued, as the stripping operations have been completed. The Hill-Annex Mine, at Calumet, Minn., has a large stripping program and will continue until late in the winter. This mine is one of the largest independent producers. The western end of the Mesaba is very active, and practically all of the properties are wash-ore operations.

▶ The Ford Motor Company has made an inquiry for 220,000 tons of iron ore —120,000 low alumina basic and 100,000 high phosphorus.

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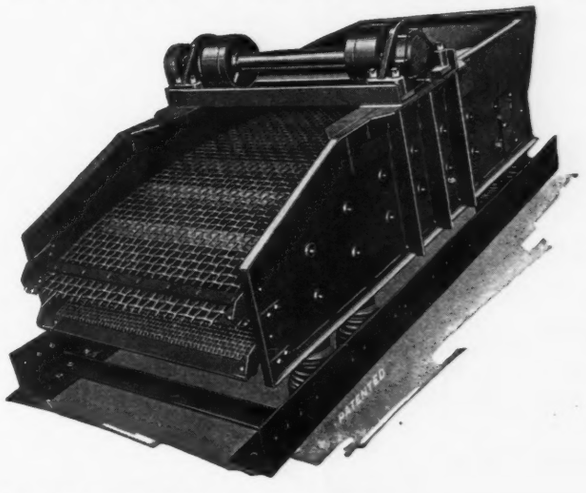

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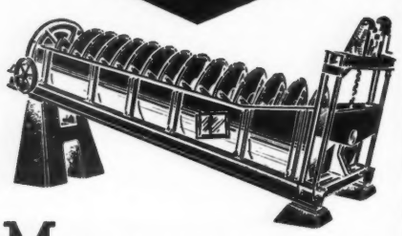

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CANADA

San Antonio Mines Sinking Internal Shaft

Six new levels to be opened — National Malartic Gold Mines will start development soon—Granby Consolidated reported considering smelter in Similkameen district B. C.

Manitoba

▶ San Antonio Gold Mines has developed the No. 38 vein to proportions exceeded by few oreshoots in Canadian mining history. With a grade of better than $12 a ton, the big vein has been opened for a continuous length of 2,100 ft. on the ninth level at a depth of 1,350 ft., averaging 15 ft. in width. On the bottom level the vein has been developed for more than 1,400 ft., where another 500 ft. of average grade ore has been disclosed in No. 16 vein, across 7 ft. Work on these two levels makes slow progress because of preparations for sinking a new internal shaft to open a block of six new levels. The president, John D. Perrin, states that development work in 1940 may lead to raising mill capacity from 325 tons to 600 tons a day. D. J. Kennedy is mine manager.

Ontario

▶ Lake Shore Mines, Ltd., Kirkland Lake, has advised its stockholders that because of increasing occurrence of rock bursts associated with greater depth of mining operations, it was decided, beginning Nov. 1, to reduce the tonnage mined. For the present tonnage has been reduced from 2,500 tons per day to 2,000 tons in order to reduce the frequency of the bursts and to allow certain contemplated changes in mining sequence to be put into effect.

▶ In December Kerr-Addison Gold Mines took its place with the ten leading gold producers of Ontario, only a year and a half after milling operations started at the rate of 500 tons a day. The mill has now been enlarged to 1,200 tons, and a long and profitable life for the mine seems assured. An ore length of 3,000 ft. has been developed to a depth of 700 ft. With the completion of the No. 3 shaft to 1,590 ft., five new levels have been established at 150-ft. intervals, and work is being rushed to open up the 1,000 and 1,300 levels to test conditions well in advance of development. Space has been allowed in the mill building for increasing daily tonnage above the present figure, depending on results in 1940, when systematic mine expansion will carry work down to 1,450 ft. Consulting engineers to the company are, M. F. Fairlie and W. H. Emens, and W. S. Row is mine manager.

▶ Gold output from Hallnor Mines, Porcupine, amounts to approximately $3,875,000 since production started in June, 1938. A development program on four new levels has been started, following shaft sinking to a depth of 1,627 ft. Ore reserves, grading better than ½ oz., are sufficient to run the 400-ton mill for four years. An 8-ft. double drum hoist built by Dominion Engineering Company and having a speed of 1,100 ft. per minute, is now in operation. The mine manager is A. L. Sharp.

Quebec

▶ Powell Rouyn Gold Mines expects to reach the main vein on two bottom levels by Jan. 20. Shaft sinking to a depth of 1,550 ft. and opening a block of six new levels have been making good headway. Conditions below the fourth level are found to be better in many places. On the 1,100-ft. level three oreshoots have been developed, one of them over a width of 30 ft. and showing higher values than in other wide sections of the mine. Ore is being trucked at the rate of 750 tons daily to the Noranda smelter, and when this can be stepped up to 1,000 tons it is planned to develop the large tonnage indicated for the south orebody, which is high in silica and grades about $3.50 a ton in gold.

▶ National Malartic Gold Mines, adjoining the Sladen and East Malartic mines, has indicated sufficient ore to supply a 750-ton mill for five years. J. P. Norrie, consulting engineer, reports diamond-drill results from exploratory work on three important ore zones and states that cross-section drilling is now in progress to test dikes of diorite and syenite porphyry within the main greenstone belt. Underground development is to be started soon, either by shaft sinking or by crosscutting from the Sladen No. 2 shaft.

▶ Belleterre Quebec Mines has deepened the No. 1 shaft to a depth of 550 ft. and is developing a new level. Early in February it is expected to complete about 200 ft. of crosscutting to reach the main No. 12 vein, the chief source of mill feed. This orebody has been extended by drill holes to a length of 3,000 ft., almost double the size formerly known. R. V. Hopper is mine manager and R. J. Ennis consulting engineer.

▶ Norgold Mines, holding 30 claims in Bousquet Township adjoining the important developments at the Cassels-Duval property, reports that United States Smelting, Refining & Mining Company has maintained its option on Block C through its subsidiary, Mic-Mac Explorations. United States Smelters also controls Cassels-Duval, which is rapidly approaching the stage for a mill decision.

▶ Siscoe Gold Mines, which started milling in 1929 as northern Quebec's pioneer gold producer, has been facing a moderate decline in grade and tonnage for the past year. Deep exploration by diamond drilling has yielded no results of importance to date, according to J. B. Lynch, president. Numerous small orebodies of the blanket type have been discovered in the course of routine development, so that ore reserves are about as before. A search is being made for outside properties. Dr. W. F. James is consulting geologist and C. O. Stee mine manager.

British Columbia

▶ Granby Consolidated Mining, Smelting & Power Company Ltd., operating near Princeton, in the Similkameen district, is strongly considering the possibilities of erecting a smelter in the same area. All Granby copper-producing operations are within an 11-mile radius of Princeton, including the steam-generating power plant of 7,500 kw. units, mine workings, and the 3000-ton concentrator.

▶ A. W. Ford, discoverer of a large magnetite deposit 5 miles from Zeballos, is said to have received word from the Department of Mines, Ottawa, that the ore samples he sent east were of high grade and should be worth $7 per ton, f.o.b. Atlantic ports.

▶ Quatsino Copper Gold Mines, Ltd., working on the property of Napco Gold, Princess Royal Island, confined its operations mainly to open cutting during the past season, according to L. S. Davidson, of Napco. The object was to discover if possible surface extensions of the existing orebodies, particularly in the gold-copper zones. Tests indicate values of 2.65 oz. of gold for shipping ore and 0.84 oz. for milling ore.

▶ Zeballos Gold Peak Mines, Ltd., have been informed by E. K. deBeck, Superintendent of Brokers, that investigation of the company's affairs under the Securities Act has disclosed no fraud nor any intent to defraud the public.

▶ Deep development at the Bralorne mine continues to produce satisfactory results, the area contiguous to the fourteenth level promising to be the best so far encountered. No ore has yet been stoped below the tenth level, but work is continuing on the Crown shaft, which will open to development another six levels below the fourteenth.

▶ November output of Cariboo Gold Quartz Mine, Ltd., in the Cariboo district, amounted to $107,555 from a tonnage milled of 9,155, average grade being $11.76 per ton. The value is calculated at a gold price of $35 per ounce. Dr. W. B. Burnett, president, recently announced payment of the regular quarterly dividend of 4c. a share plus 2c. bonus, half of this bonus representing a surplus resulting from the increased price of gold due to the premium on the United States dollar.

▶ It is reported that the Conwest Exploration Company, of Toronto, Ont., has optioned the Hunter Basin property in the Telkwa area of the Omineca, near Smithers. F. C. Tomlinson, field engineer of the company, is said to have negotiated an agreement for exploration of the property.

▶ Germansen Mines, Ltd., has completed its large flume building project and, according to R. C. McCorkell, managing director, the property will go into production next spring. Owning sixteen placer leases on the Germansen River, Omineca district, work has been started some time ago on a 10-mile ditch system with a 15-ft. bottom. The system will ultimately carry 300 cu.ft. of water per second and will be used for hydraulicking.

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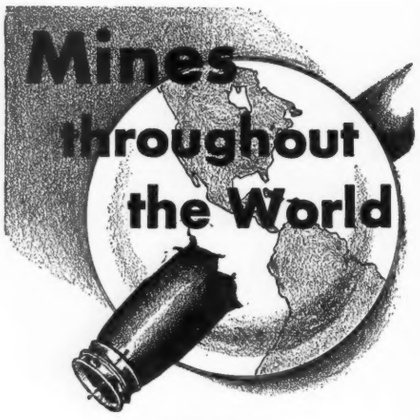

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AFRICA

Demand for Metals Begins to Increase

Declining evidence of concrete plans for peace proposals influences greater activity at many mines—Greater mechanization of operations being considered at several properties

▶ The war is influencing mining both unfavorably and favorably. It has checked —almost stopped—the launching of new companies, and is increasing taxation. On the other hand it is quickening the demand for mineral products generally —copper, tin, zinc, lead, tungsten, antimony, cobalt, gold, petroleum, coal, aluminum, iron, and all the minor metals used in alloys. For a time it appeared that the demand for metals in the industries of peace might decline, but this demand is now reviving. The surplus stocks of metals which had been an obstruction for a decade past are now largely absorbed and the producing mines are feeling the urge to increase outputs. Just as low metal prices have required the technologist to strive to reduce costs, so demand is now calling upon him to discover short-cuts to the expansion of production. These two influences, one following the other, will be of great benefit to the mining industry of the future.

▶ Further evidence that Western Holdings interests have confidence that they will succeed in developing good producing mines in the Orange Free State, 100 to 150 miles southwest of Johannesburg, is supplied by the announcement that they have now purchased the mineral rights of the Farm St. Helena No. 642, Ventersburg district, under the terms of the option they held. It will be recalled that a St. Helena borehole revealed very satisfactory values.

▶ Venterspost Gold Mining Company, Ltd., has reached the production stage after an expenditure of approximately £4,000,000 on development and plant. The reef it is mining occurs at a depth of 2,000 ft. or more. Two shafts have been sunk to depths of some 3,000 ft. and 2,000,000 tons of ore developed, of excellent grade.

▶ The Witwatersrand again set up a new high record in October by producing 1,102,212 oz. of gold. This compares with 1,071,991 oz. in September and the previous high record of 1,101,373 oz. in August.

▶ During the first half of this year Witwatersrand gold mining companies paid and declared £9,505,000 in dividends. This was from working profits of some £17,196,000, the difference being largely absorbed by royalties and various forms of taxation. As profits will be a little larger in the closing half of the year, dividend rates are expected to be generally maintained. There have been some protests against the action of the South African government in taking to itself all receipts for gold sold above a price of 150 shillings per ounce, but they are not vigorous protests. The desire to finance and win the war is so unanimous that sacrifices, even when they seem to be unduly heavy, are accepted with little complaint.

▶ The Rhodesian copper producers, Roan Antelope, Rhokana, and Mufulira, have entered into a contract to sell a large proportion of their outputs to the British Government at a fixed price for the duration of the war. It is the common understanding that the amount is 80 per cent of their production, and that the price is about £46 per long ton for blister copper. Despite the price being much below the present world price the heads of the companies are apparently well pleased with this arrangement. A. Chester Beatty has said: "The Government's policy of preventing profiteering is a sound one, as no company should benefit by the great suffering which a war causes, and I think stockholders should be satisfied with moderate earnings during the period of war unsettlement." The government contract will enable the companies to operate their properties at full capacity.

MEXICO

Lane Rincon Mines Passes to Employees

Doubt exists whether miners can maintain profitable operations because of little ore available — Mining industry threatened with more taxes and outlook for operators and cooperatives alike, is not bright

▶ The advent of winter found much anxiety in the Mexican mining industry, chiefly because of a deepening of its depression, a condition that the war has not remedied, for, it is learned, no important buying of belligerent metals and minerals from this country can be looked for until about July or August, as the buyers are bought up, as far as Mexico is concerned, and impending taxes, heaviest of which appears to be one on excess profits, are a deterrent on operation. Repeal of the 4 per cent tax on all exported money has been of some benefit to mining, as it can now obtain more cheaply machinery and other supplies it must get from abroad. Purveyors to the industry continue to benefit from rather good orders that were placed for machinery equipment, and supplies, by companies that anticipated big war business and felt that they must step up production. Installation of this material is some little stimulation and is providing better equipment on several mining properties. These installations are expected to continue well into the winter.

▶ Another mining company has gone into the hands of its workers with the transfer of properties of Lane Rincon Mines, Inc., worth about 2,000,000 pesos (some $400,000) at Temascaltepec, State of Mexico, to its employees to conduct cooperatively. This action was taken because the company contended that further work would be unprofitable. The properties include mines, machinery, equipment, materials, and an electric power plant. Mining circles are dubious about the success of this mining cooperative, as it lacks money and ore.

▶ Representative Mexican mining men view with frank alarm the bill President Lazaro Cardenas has presented to Congress which provides an excess profits tax, a levy of from 20 to 45 per cent on annual profits of more than 100,000 pesos (about $20,000) that represent over 15 per cent of invested capital. Ing. Javier Sanchez Mejorada, president of the National Mining Chamber, declared that this tax will "further disorganize the mining industry," as he contends that the mining business is of such a fluctuating nature that it would be a heavy blow to impose this tax upon it. He averred that the industry is now in a most critical position. Protests against passing the bill, an action which is expected to be taken before the end of December, are pouring in upon Congress from the mining and other industries.

▶ Intensive operation of copper mines in the Tatila Somelohuaca district, Vera Cruz, that were abandoned by a French company several years ago, is being arranged by a group of Spanish political refugees, all of them experienced miners. After examining the mines, the Spaniards sent a delegation to Mexico City to raise funds for acquiring charge and working these mines. Much money is being raised for the purpose among wealthy Spanish businessmen in the Mexican capital. The Spanish miners told the Mexican government that they are confident that they can successfully exploit these copper mines.

▶ Seven mining companies are among the 27 important companies in Mexico that were denied an order by the first district court, Mexico City, to upset the mandate the Ministry of Public Education issued on Nov. 2, 1937, that teachers in schools all industrial and agricultural companies are obligated to maintain for the children of their workers must be considered as employees of the firms. The mining companies are: American Smelting, Peñoles, Kildun, Cia. Minera Santa Maria de la Paz y Anexas en Matehuala, Cia. Minera La Parreña, Consolidacion Minera del Parral, and Cia. Carbonifera de Sabinas and Cia. de Combustible Agujita, the latter two coal-mining companies. It is anticipated that all the 27 companies will appeal to the federal supreme court.

▶ Labor peace was obtained by Cia. Minera Consolidada, S.A., by allowing employees of its Piedras Negras unit, Coahuila, salary increases of 70 per cent.

▶ Labor troubles have eased up a bit, but companies continue to go into the hands of their workers.

▶ Mexican Candelaria need not post a cash bond of 200,000 pesos (some $40,000) with the Ministry of Agriculture to guarantee the concession the ministry granted it to use waters of the Las Truchas River, San Dimas municipality, Durango, for its hydro-electric plant, the federal supreme court held in granting the company an order setting aside the ministry's demand. The court held that the Candelaria is not required to make this deposit, as the water it is using is to increase its working facilities. The case is seen as a precedent in the water-use rights of mining companies.

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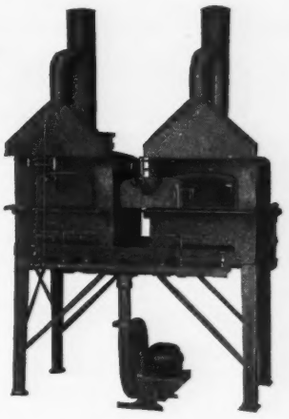

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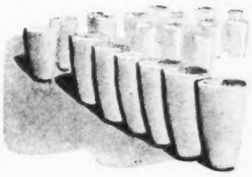

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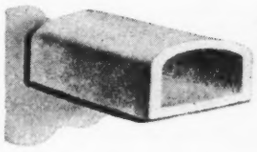

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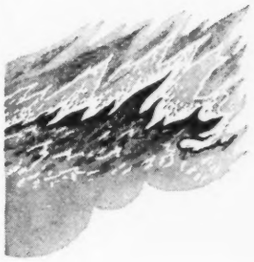

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AUSTRALIA

Lanceford Gold Mines Adds to Reserves

Underground diamond drilling determines extension of ore zone—Gold Mines of Kalgoorlie operating at higher rate—Aberfoil Tin, N.L., in Tasmania, improves grade of ore by underground sorting

Western Australia

▶ Development of further ore reserves at the mine of Lancefield (W. A.) Gold Mine, N. L., at Beria, is indicated by the results of work now in progress at No. 13 level of the mine, where the drive is being extended in what is considered to be the "northern oreshoot," previously worked to shallow depths only. The drive has now been in payable ore for a length of 400 ft., the ore asaying 5.5 dwt. per ton over a width of 7 ft.

▶ Gold Mines of Kalgoorlie, Ltd., Kalgoorlie, has completed extensions to its mill to bring capacity up to 12,000 long tons monthly, and is now operating at that rate. It is intended to reduce the mill-head grade, and probably ore averaging about 5 dwt. instead of 7 dwt., as heretofore will be treated. Pre-cyanidation process with flotation of the cyanide tailing is employed. J. Cornelius is superintendent.

Wau, the thriving township of the New Guinea Goldfields. Its only access to the coast is by airplane.

Victoria

▶ Gold Mines of Australia, Ltd., which is carrying out boring operations on leases owned jointly by it and Gold Exploration & Finance Company of Australia, adjoining those being succesfully dredged at Newstead by Victoria Gold Dredging Company, reports that recent drilling on a tributary of the main lead indicates the probability of an appreciable extension of the payable ground.

▶ Central Nell Gwynne Gold Mining Company, N. L., one of the more successful Bendigo companies, reports a net profit of £33,125 Aust. for the half year ended Sept. 30. During the period 15,030 tons of ore were treated, returning a total of 5,697 oz. gold, together with pyritic concentrate valued at £2,453. Costs were reduced by 1s. 2d. to 23s. 5d. per ton.

▶ Dump re-treatment in Victoria by subsidiaries of Placer Development, Ltd., is giving good results. During the year ended April 30, Rutherglen Gold Dumps, Ltd., the earliest of these companies to go into operation, recovered 6,995 oz. of gold from the treatment of 188,683 short tons of dump material, an average of 6s. 9d. per ton, net profit being 3s. 8d. per ton. This company has 715,000 tons left to treat. Gold Dumps Pty., Ltd., another subsidiary, has three plants operating in the Carisbrook and Ballarat districts.

▶ Another attempt is being made to work the Lamplough deep lead, on which an English company some years ago spent a large sum on development work with unsuccessful results. A local syndicate is undertaking the work on this occasion, but in view of the earlier failure, prospects would not seem to be bright.

▶ Cocks Pioneer Gold & Tin Mines (1934) N. L., which is operating a hydraulic sluicing property at Eldorado, North Eastern Victoria, encountered difficult conditions during the year ended June 30, mainly due to the intrusion of a hard seam of overburden, which adversely affected the rate of sluicing. During the period, 729,220 cu.yd. of wash was sluiced for a yield of 1952 oz. gold and 79 tons tin oxide, together valued at 10.91 d. per cu.yd., working costs were 9.39 d.

Tasmania

▶ Aberfoyle Tin, N. L., a tin and wolfram producer in the Northeast of the State, at Rossarden, had a net profit of £14,053 Aust. for the year ended June 30, as compared with £9,483 for the preceding year. The increase was mainly due to an improvement in the grade of ore treated, which was effected by sorting of waste rock underground. The development of a block of ore below No. 2

TRI-VIBE GIVES YOU
Triple Powered Screen Vibration

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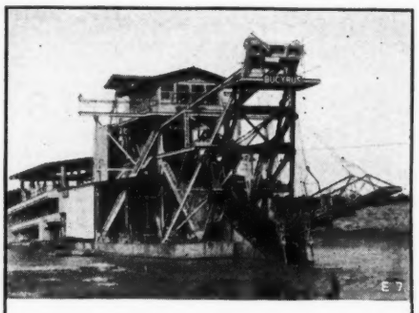
VIBRATING SCREEN

Like ethyl in gas, TRI-VIBE in Type C Leahy Screens puts extra energy in performance. There is faster action, and dynamic differential vibration is transmitted to every square inch of free-swinging screen jacket. You handle *fine mesh screening* without blinding and increased production at reduced cost.

Write for Bulletin No. 14

The Deister Concentrator Company
The Original Deister Co.
Est. 1906
903 Glasgow Ave., Fort Wayne, Ind.



Placer Dredges with a Background

Placer dredges built by Bucyrus-Erie have operated successfully in placer deposits all over the world. Your dredge, built by Bucyrus-Erie, will be the best available because of that experience, because of the unequalled facilities of Bucyrus-Erie for designing and building the RIGHT dredge for YOUR particular job. Ask for full information.

BUCYRUS-ERIE COMPANY
SOUTH MILWAUKEE, WISCONSIN, U. S. A.

level, estimated at 130,000 to 140,000 tons or enough for about nine years' mill feed at present rates, is now under way.

▶ Output of the Mount Lyell Mining & Railway Company Ltd., Queenstown, for the year ended Sept. 30 was 13,393 tons of blister copper from the treatment of 1,085,933 tons of ore, as compared with 12,766 tons from 1,032,128 tons of ore during the preceding twelve months. The steep increase in tonnage treated, coupled with decreasing grade, which has been a feature of the company's operations for the past few years, appears to have ceased for the time being.

▶ For the 52 weeks to Oct. 28 King Island Scheelite, N. L., operating a property on King Island, in Bass Strait, treated 27,310 tons of ore, producing 164.5 tons of scheelite concentrate. This was at the rate of a little over 3 tons weekly—lately increased to about 5 tons from the treatment of 650 tons weekly.

New South Wales

▶ North Broken Hill, Ltd., Broken Hill, had ore reserves amounting to 5,084,000 tons at June 30, an increase of 9.000 tons for the year. An important development during the twelve months was the disclosure, by diamond drilling, of high-grade ore of a true width of 160 ft. on the 2,450-ft. level. The new mill is now operating satisfactorily, recoveries during the first three months of the current financial year being 95.2 per cent lead and 87.4 per cent silver in the lead concentrate, and 86.7 per cent zinc in the zinc concentrate.

▶ Broken Hill South, Ltd., has ore reserves amounting to 2.600,000 tons, not taking into account incompletely developed ore, nor ore below the 1,480-ft. level.

Queensland

▶ Net profit of Golden Plateau, N. L., Cracow, for the year ended June 30 was £128,202 Aust., only £7,734 less than in the previous year, in spite of the marked lowering in the grade of ore treated, which dropped from about 9 dwt. to 5.5 dwt. per ton. The rate of throughput was raised during the period from 4,500 to 6,500 tons per month, thus achieving a drop in costs from 27s. 6d. to 22s. 6d. per ton.

New Guinea

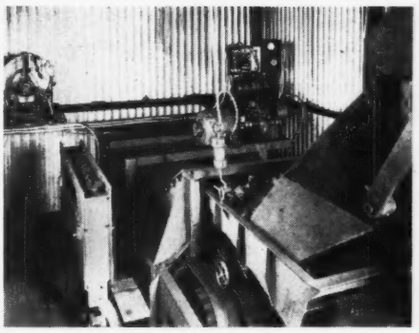
▶ Dredgeable gravel reserves of Bulolo Gold Dredging, Ltd., at May 31 were estimated at 182,000,000 cu.yd. a drop of 10,000,000 cu.yd. over the year. In addition there is 20,000,000 cu.yd. which is suitable for hydraulic treatment. The company reports that for the year ended May 31, 14,688,000 cu.yd. were treated for the recovery of 158,970 oz. gold and 67,039 oz. silver. This production was obtained from six dredges. Since the close of the period, Nos. 7 and 8 dredges have started work and it is possible that production in the future will be not less than 15,000 oz. monthly. Working costs, exclusive of amortization, were 9.84 Canadian cents per cubic yard, or including the 5 per cent gross royalty paid to the government, 11.72c. Construction of another hydro-electric power plant has started to be finished in June, 1940.

ELECTRIC VIBRATION plus ELECTRIC CONTROL

. . . Two unique factors that "add up" to BETTER, LOWER-COST MATERIALS HANDLING with JEFFREY-TRAYLOR EQUIPMENT

For Instance . . .

"WAYTROL" FEEDS BOILERS UNIFORMLY . . . KEEPS ACCURATE RECORD OF COAL CONSUMED



• A continuous, uniform flow of a given weight of coal per hour assures maximum efficiency for boilers . . . effects substantial savings in cost. The Jeffrey-Traylor "Waytrol," radically different in design and principle, assures a constant feed by registering every slight change in weight, making instant correction by speeding up or slowing down the vibrating feeder. In addition, the "Waytrol" provides an accurate record of the coal handled and gives a valuable check on consumption. Again, the J-T exclusive all-electric principle points the way to lower-cost production through improved handling methods. Why not let J-T engineers make specific applications to your needs?

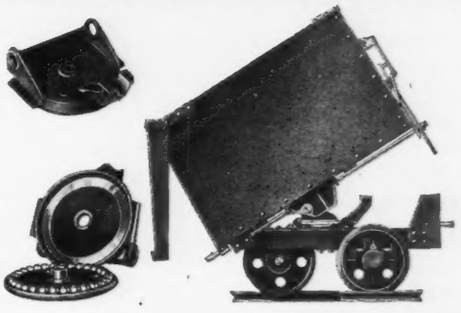
• SEND FOR CATALOG No. 650-J describing in detail the various applications of J-T electric vibrators.

JEFFREY-TRAYLOR DIVISION
The JEFFREY MANUFACTURING Company
974-99 NORTH FOURTH STREET . . . COLUMBUS, OHIO

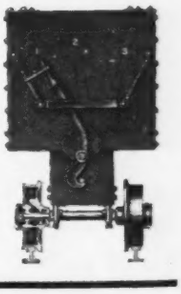
MODERNIZE with the New KOPPEL ALL STEEL CAR EQUIPMENT

Designed and built by engineers with years of experience, Koppel All-Around Dump Cars represent just one of the many types and kinds of modern mine cars equipped with anti-friction bearings available for your every need.

The body of this balanced type, all-around dump mine car revolves on a ball-bearing turntable and may be dumped on either side or over the end as shown. Single dump control lever and door lock are conveniently located at end of body as illustrated. Write for descriptive Bulletin on the Koppel line of cars.



Easy turning under load is assured by ball-bearing turntable. Note 3 positions of control lever. In first position body and door are locked—second, body unlocked permitting turning to dumping position. Third, body and door *both* unlocked for dumping.



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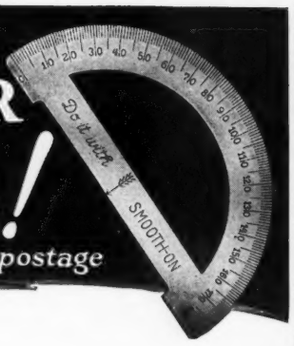
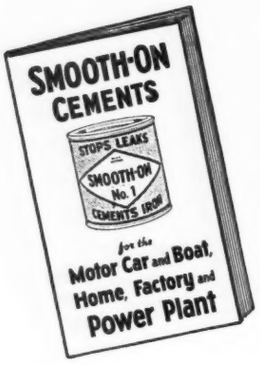
(KOPPEL DIVISION)
GRANT BUILDING · PITTSBURGH, PA.

THIS USEFUL PROTRACTOR FREE!

— and we pay the postage





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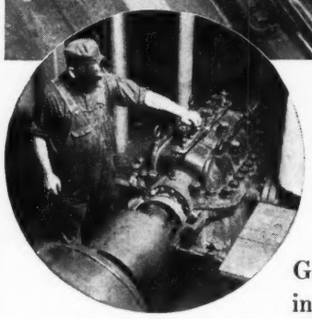

8 MONTHS' *service*

GARLOCK 234 *Rotopac* Packing gives eight months' service on these 6-stage boiler feed pumps operating at 1800 R.P.M. and delivering 100 G.P.M. at 425 lbs. pressure, 230°F. Use GARLOCK 234 on all your rotary or centrifugal pumps handling hot water, cold water, caustic solutions or weak acids—for long, dependable service. All sizes from ⅛" to 1¼".

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GARLOCK 234

EQUIPMENT NEWS

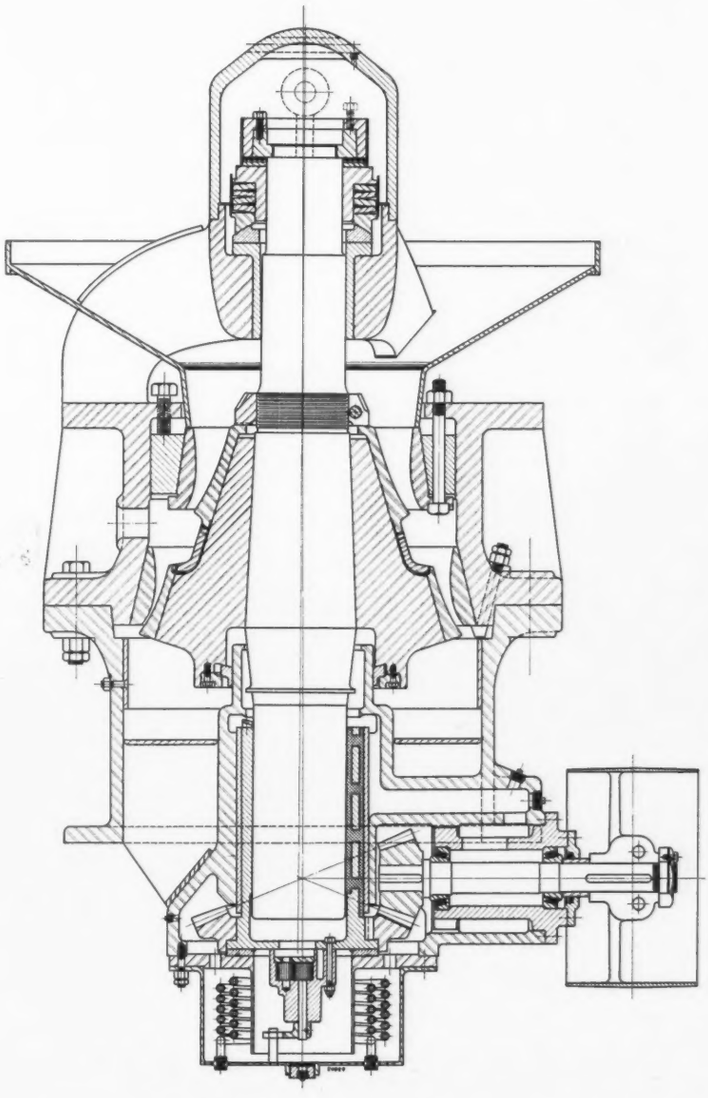
New Multi-Stage Reduction Crusher

TRAYLOR Engineering & Manufacturing Company, Allentown, Pa., announced late in December a new crushing unit known as the Traylor-Stearns fine reduction crusher. The unit contains two crushing stages known as the upper stage, which crushes properly fed material, and supplies the lower stage with adequate material all around its crushing bowl. The upper stage is said to accomplish about 50 per cent of the crushing, thereby providing the proper feed for the lower stage. Simple adjustment of the discharge opening of the upper stage is said to enable this condition to be maintained permanently.

The crushing head comprises two separate manganese-steel bell-head mantles of different diameters assembled one above the other with a common head center and having a suitable steel inclined spacer plate between the two. The effect of this design is two "short" heads superimposed.

The concaves are made of manganese-steel and are of the manufacturer's curved design and ring type, each matching its part of the composite head. The discharge opening of the upper stage is said to be independently adjustable by means of wedge rings that raise or lower the upper ring concave as may be required; adjustment of the lower stage discharge opening is accomplished in the usual manner by raising or lowering the main shaft. The manufacturer points out the following advantages of the design of this crusher for producing between ⅛ in. and 9/16 in., (closed discharge opening of the lower stage) according to size of machine used: (1)—no packing at any settling; (2)—all power applied to machine is used for crushing rock; (3)—freedom from obstruction in the crushing bowl functions to produce cubical output; (4)—provisions made for minimum breakage of parts; (5)—in case power is shut off leaving crusher full of stone, the split support of the main shaft may be released to allow the head to be lowered to a point that will free the stone; (6)—flexibility of varying the percentage of sizes in the finished product, because independent adjustment may be made of the discharge openings of both crushing stages to meet requirements of each installation. The table shown herewith indicate results obtained from a 3-ft. Traylor-Stearns multi-stage fine-reduction crusher operated at standard speed and eccentric throw on Pennsylvania and New Jersey trap rock with a feed through 2¼ in. on ¾ in.

Discharge opening of lower stage closed side (inches).	3/16	¼	5/16	3/8	7/16	½	9/16
Capacity per hour (tons of 2,000 lb.)	54	57	60	63	66	69	72
Horsepower used (from recording watt meter)	71	67	63	59	56	53	50



Safety Mine Prop

MARKHAM Products Company, Birmingham, Ala., announces its adjustable safety mine prop that is designed principally for use in mine timbering. The prop is raised against the timber set or mine roof and the lower wedge shown in photograph is driven to secure its position. The drive wedge in the automatic cap board at the top is then driven securely and safely against the roof. Then the cap board is pivoted to insure good contact against slanting or uneven roof and the cap is designed with four holes in the top plate so that wooden boards may be attached as a cushion for safety and greater bearing purpose. It is said an average miner can set the device in 10 to 15 seconds. Under dan-

PAN-AMERICAN

JIGS

Now standard equipment on 10 out of 11 Jig-Equipped BUCKET-LINE DREDGES in the United States

The reasons are:

- Low operating cost (less than $.0006 per yard dredged).
- Ease of operation.
- Substantial savings on riffle tailings losses (which often pay for the jigs in a short time).
- Trouble-free, reliable performance.

Other Pan-American Jigs on dredges in New Guinea, Colombia, F.M.S. and the African Gold Coast have produced record savings for several years.

Large Placer Jigs for roughers. Small Pulsator Jigs for cleaners, or for roughers on small operations.

Write for Bulletins PLE and PJE

This dredge uses Pan-American Jigs

PAN-AMERICAN ENGINEERING CO.

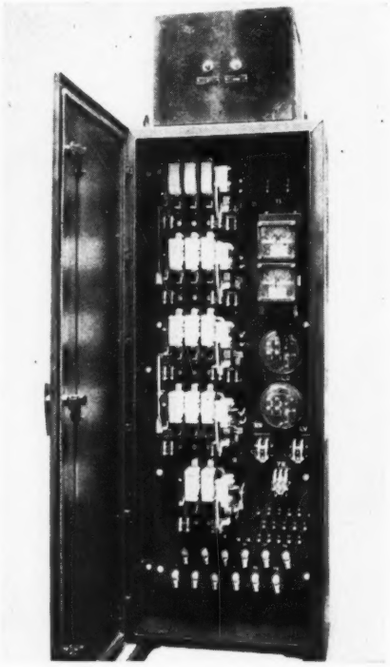
820 Parker St., Berkeley, Calif., U.S.A.

Design, Metallurgical Testing and Field Consulting Service; Manufacturers of Mill and Placer Recovery Equipment.

gerous conditions the prop can be removed and pulled out by placing ropes of knockout blocks in hooks provided, then getting back out of danger and pulling rope to drive wedge back.

Skip-Hoist Controllers

NEW heavy-duty skip-hoist controllers for squirrel-cage motors are announced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The seven controllers in this line cover the entire range of skip-hoist duty, high or slow speed, balanced or unbalanced, single speed or two-speed, and arranged for non-automatic, semi-automatic, or automatic operation. The units



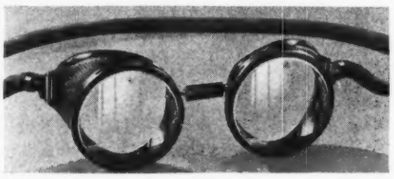
consist of contactors and relays mounted on an ebony asbestos base, supported by angle-iron framework or inclosed in a suitable Nema Class I or V sheet-steel cabinet. Where dust- or water-tight cabinets are used and equipment is subject to variations of temperature, a small heater is recommended to eliminate condensation. Overload protection as supplied by a thermal overload relay is the inverse-time limit form. Either hand or automatic reset may be supplied. Low-voltage protection, preventing unexpected and unsupervised starting, is also provided. Definite time-limit acceleration is secured by a direct-current inductive time-limit relay and a rectox rectifier. Cycle timing through an accurate synchronous motor-driven relay is used for automatic or semi-automatic operation to control the timing period for loading and dumping.

Industrial Tractor

MODEL "IB," a new industrial tractor, has been introduced by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. It is specifically designed as an industrial tractor and is built low, short, compact and powerful to handle all types of industrial work. With 13.5 drawbar horsepower, and weighing 2,140 lb., this unit is said to have the stability to haul up and down inclined ramps without tipping. It has both a foot brake and individual hand brakes on the rear wheels to facilitate maneuvering in cramped quarters. A structural-steel frame surrounding the engine and radiator can be provided so that extra equipment can be mounted. This frame also protects the vital parts of the tractor and serves as a bumper for pushing jobs.

Safety Goggle

AMERICAN Optical Company, Southbridge, Mass., announces a new No. 303 Super Duralite-50 safety goggle with a non-rubber headband. The eyecups are said to be molded from a special material



that combines light weight for comfort with high tensile strength for long wear. This material is not affected by exposure to water, oil, grease, and perspiration and can be sterilized by any method without harm. The non-rubber headband consists of a spring and ball chain covered by a colth sleeving and when adjusted it maintains the same tension indefinitely but may be readjusted for different head sizes. Lenses regularly supplied are the 6.00 curve clear Super Armorplate type. The caps which hold the lenses in place are precision-threaded to insure easy removal for replacement of lenses. Metal screens provide adequate ventilation.

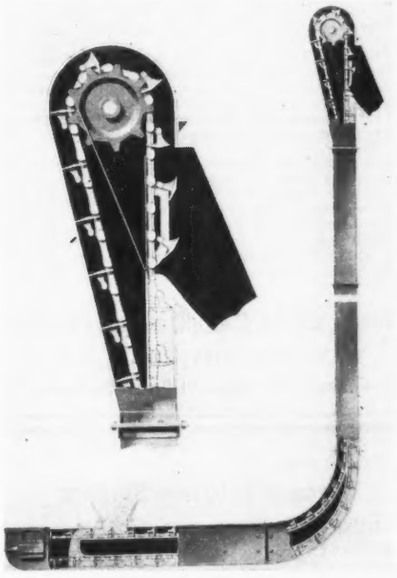
Light-Weight Jack

TEMPLETON, KENLY & CO., 1020 South Central Ave., Chicago, announce a new light-weight single-acting, automatic raising and lowering emergency jack, having a capacity of 5 tons. The

jack tilts on its base, when the base pawl is disengaged, permitting angular jacking or pushing and pulling. A 4½ ft. chain, which is fitted with a grab hook, is as a sling. The unit weighs 64 lb., is 22 in. high, has a 14-in. lift and is furnished complete with a 4½-ft. chain, an auxiliary cap shoe, and a 36-in. heat-treated steel lever bar.

Elevator Conveyor For Granular Material

OUTSTANDING among the many new pieces of equipment announced early in 1940 is the Mass-Flo elevator-conveyor by the Jeffrey Manufacturing Company, Columbus, Ohio. This new unit is said to offer a low cost and unique method of handling all kinds of granular ma-



terials. The unit is simple in design and construction, consisting of a steel casing through which solid pivoted flights, spaced at intervals on a single strand of chain, move the material horizontally or vertically in a solid mass or with partial load. The enlarged view of the discharge point shows how the flights are discharged of their load by means of a tripper. As each flight carries a full or partial load, depending on rate of feed, the unit can be emptied after the feed stops. Fed or discharged at any point, this elevator-conveyor handles material with little agitation; thus, breakage and degradation are said to be practically eliminated. It is self-feeding and self-cleaning, and requires small installation space.

Magnetic Telephone

A NEW telephone instrument which gets its power solely from the speaker's voice and enables the user to call any of five other stations has been announced by the Western Electric Company, 195 Broadway, New York, N. Y. Failure of electrical supply cannot affect the telephone's operation, because its electrical voice current is generated internally by the impact of sound waves on a special diaphragm, and hence it is independent of external power. A self-contained, hand-operated generator provides for signaling. As many as six

CALMIX

CUPELS

Save Time and Bother—Step Up Efficiency

Calmix Cupels absorb more lead than bone ash cupels. The greater absorbing power of Calmix permits the use of smaller cupels.

Calmix Cupels save silver losses. Silver loss with Calmix Cupels, 0.66%; with bone ash cupels, 1.54%, by actual test under uniform conditions.

Calmix Cupels have greater conductivity than bone ash. They respond quickly to temperature regulation. The temperature of the molten lead button is lower in a Calmix.

Calmix Cupels will not crack or check in the muffle. They are uniform in density.

Calmix Cupels are ready to use. They need no initial drying and will cupel perfectly, even if they are damp when placed in the muffle. Made in two standard sizes.

Equip your laboratory with Calmix Cupels today

Write Department E-1 for literature and samples

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BENDELARI DIAPHRAGM ORE JIGS

For every gravity separation

5 types 5 sizes

42" Low California type

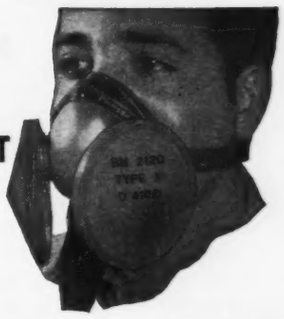
These jigs are used to hutch up to 90% of gold when in closed circuit with ball mill and classifier.

On two dredges using riffled launders from distributor to jigs all of the gold saved on the Bendelari jigs is—100 mesh. 70% of it is—200 mesh.

F. N. BENDELARI
Joplin, Missouri, U. S. A.
(When writing please describe the ore you are interested in concentrating)

DUST PROTECTION FOR YOUR MINERS

SAFETY plus COMFORT



PULMOSAN D-4100 DUST RESPIRATOR

Approved by U. S. Bureau of Mines

The D-4100 Dust Respirator is designed for long-period protection in severe concentrations of fine dusts. It provides safety, comfort, easy breathing, serviceability. It features specially designed double felt filter, aluminum body, patented rubber face cushion, positive exhalation valve, all-rubber headbands. Order a D-4100 for trial. Ask for details and prices.

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Dept. EM, 176 Johnson St., Brooklyn, N. Y.

"MICHIGAN" BABBITT TAPE

If you want a chain tape that can stand the gaff, you want a "Michigan." The extra tough steel line is coated with a white metal and markings are deeply stamped into long-wearing babbitt metal. The sturdy dull-nickeled reel is comparatively light weight. Folding winding handle permits easy and rapid winding. In every respect this tape is built to withstand all kinds of hard use.

Write for catalog 12A.

LUFKIN

SAGINAW, MICHIGAN • New York City

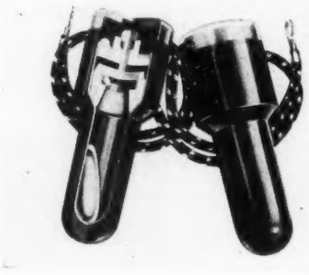
TAPES · RULES · PRECISION TOOLS

instruments may be connected to form a network in which calls may be made between any two telephones or "conferences" held over the entire system. To place a call, the user turns a simple rotary-selector switch to the station desired and spins a small signaling crank on the side of the instrument. This causes the distant telephone to emit a high-pitched tone signal of great penetrating power. Additional stations may be combined in the one system, but selective signaling is limted to six positions.

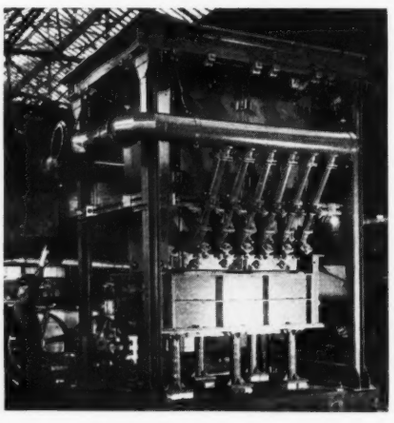
Known as the 11A magnetic telephone, the new instrument is intended for communication only at close range, but a measure of its effectiveness may be gained from the fact that suitable transmission was obtained over an artificial line of No. 9 copper wire 200 miles in length.

Mercury Switch

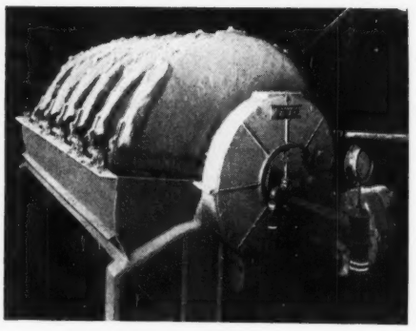
DURAKOOL, Inc., Elkhart, Ind., announces a silent, unbreakable, and noninflammable mercury switch, having the feature of new double reduction (two



reducing agents) that is said to prevent deterioration of the mercury and eliminate possibility of contact interruptions. These commercial mercury switches, available over 40 amp. capacity, and up to 200 amp., are said to operate on small tilt with remarkably little energy, and allow many new applications, from wall switches to motor starters. Due to the steel-shell inclosure, they appear to offer absolute safety in any explosive atmosphere, and with a rubber covering may even be used under water or other liquid.



This small blast furnace for smelting copper ore was recently built for export to Africa by the mining division of The Allis-Chalmers Manufacturing Company, Milwaukee, Wis. It is capable of handling a 100-ton charge per day—the copper matte produced being later treated in a copper converter.



CONTINUOUS - VACUUM

FILTERS

Illustration above shows a 6-ft., 6-disc Eimco filter dewatering zinc flotation concentrates, at the rate of five tons per hour, in modern 800-ton mill of Silver King Coalition Mines Co. Many other famous producers, throughout the entire mining world, are securing better results from Eimco Disc Filters, at very much less expense for operation and maintenance, than has ever before been possible.

• Bulletin 402 gives complete information reguarding Eimco's modern, new-feature drum and disc filters. Write today for free copy and tell us about any present or prospective filteration requirement. Our laboratory tests, recommendations, and estimates involve no charge or obligation—may easily help you to achieve important savings.

The EIMCO Corporation

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New York Chicago El Paso Sacramento

Mechanical-Time Starters

GENERAL ELECTRIC Company, Schenectady, N. Y., announces the development of a new d.c. definite mechanical time starter for general-purpose constant-speed motors, where jogging is not required. Its rating is up to 5 hp. 115-volts, and 10 hp., 230 volts. The new starter consists of a solenoid-operated multi-finger contactor with an overload relay. It is said to be unique in that it employs a new time-delay escapement mechanism. In constant engagement with the operating shaft, this mechanism restrains the shaft in the starting motor, but permits quick opening through the action of a positive overrunning clutch. A new isothermic overload relay makes possible improved overload protection, for it works on the heater and bimetallic strip principle, and is easily set for either manual or automatic resetting after overload.

These starters may be applied to constant-speed motors up to 1,800 r.p.m. that do not require more than 150 per cent of full-load torque to start nor longer than 10 sec. to attain full speed. With the proper accessories, the starters will provide overload and undervoltage protection.

Switch Signal Device

THE Portable Lamp & Equipment Company, 78 First Ave., Pittsburgh, Pa., recently introduced a new switch signal device to the mining industry, which is designed to increase safety in underground haulage operations. Employing

red, green, and white reflector buttons instead of electric lights, the signal can be seen by an approaching motorman 1,000 ft. away, allowing him ample time to adjust himself for any condition of the switch. An electric cap lamp will pick up the signal 600 ft. away. Outstanding features of this new Portable product are said to be economy and simplicity of installation and operation. The device is mounted on a tie, opposite the switch throw, in such a position that the connecting rod will extend from the signal to the hole in the switch bridle bar. When the switch is thrown, the bridle bar automatically moves the paddle arm and changes the signal.

INDUSTRIAL NOTES

S. G. Baker has been appointed director of sales of the explosives division of E. I. du Pont de Nemours Company, with headquarters in Wilmington, Del. He succeeds **P. J. Kimball,** who has been transferred to the manufacturing division and will act as liaison between manufacturer and sale of explosives.

James F. McCarthy, Jr., Julius Ramstedt, and **Walter E. Jones,** of Wallace, Idaho, have organized the Bitco Company, Inc., to sharpen detachable drill bits. The new plant is said to be the only bit-sharpening factory in the United States. The new Bitco process is said to increase the number of times detachable bits can be resharpened and used.

The appointment of **Harold W. Stoddart** to the position of manager of its turbine well pump division has been announced by Worthington Pump & Machinery Corporation, Harrison, N. J.

Bucyrus-Erie Company announces the appointment of J. F. Tait as district manager of its Pittsburgh sales district, with offices at 1502 Clark Building, Pittsburgh, Pa.

C. W. Barnes has joined the W. W. Sly Manufacturing Company, manufacturers of dust-control systems and blast cleaning equipment, Cleveland, Ohio, in charge of sales promotion and advertising.

Completion of the most modern distribution transformer plant in the world was announced recently by William Watson, vice president in charge of manufacturing of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

BULLETINS

Crushers. Traylor Engineering & Mfg. Co., Allentown, Pa. Bulletin 113 describes and illustrates the manufacturers new multi-stage fine reduction crusher. Pp. 8.

Placer Dredge. Bucyrus-Erie Co., South Milwaukee, Wis. Bulletin PD4 is a comprehensive reference manual on placer dredging and describes features of the company's dredges. Pp. 35. Bulletin D-1007, describes and illustrates the company's **Electric Shovel and Dragline.** Pp. 32. **Draglines** made by the manufacturer are described and illustrated in Bulletin DL-1.

Aluminum. Aluminum Research Institute, 308 West Washington St., Chicago, Ill. Second edition entitled "Standard Methods for Sampling and Analyzing of Aluminum and Certain Aluminum Alloys." Pp. 31.

Oil and Grease Separator. Gale Products Co., 50 West St., New York, N. Y. Folder describes the Gale separator for use in reclaiming oils and greases. Pp. 4.

Valves and Accessories. The Lunkenheimer Co., Cincinnati, Ohio. Catalog 78, is a handsomely bound volume containing complete information on the manufacturer's line of valves and valve accessories. Many engineering tables are enclosed. Pp. 136.

Tail Rope Sheaves. Sullivan Machinery Co., Michigan City, Ind. Bulletin 76D describes and illustrates the manufacturer's sheaves for use in slushing and scraper loading. **Single Drum Hoist.** Bulletin 76-R describes the company's Class L-3 reversible "Pistonair" single drum hoists. **Anti-Freeze Systems.** Bulletin R-16 describes anti-freeze systems for various compressor installations.

Lathes. The South Bend Lathe Works, South Bend, Ind. Catalog 100 is an attractive presentation of the company's 75 different sizes and types of the manufacture line of back-geared screw cutting lathes. Pp. 112.

Corrosion-Resistant Valves and Fittings. Crane Co., Chicago. Circular 312 is offered by the company for selection of piping materials for process services. It describes and illustrates corrosion-resistant valves and fittings and mentions chemical and physical properties of various alloys used in their company's pipe manufacture. Pp. 56.

Pebble and Ball Mills. The Patterson Foundry & Machine Co., East Liverpool, Ohio. Catalog 392 describes and illustrates the company's ball and pebble mills. Pp. 32.

Magnetic Telephone. Graybar Electric Co., 420 Lexington Ave., New York, N. Y. Bulletin WECO-T1543 describes a sound-powered magnetic telephone. Pp. 4.

Air Compressor. Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y. Bulletin 767 describes and illustrates the manufacturers new CP diesel-driven two-stage air compressor. Pp. 11.

Milling Machinery. W. W. Gibson, 1801 Webster St., Alameda, Calif. Catalog 17 describes and illustrates the latest improved line of mill equipment by the manufacturer, such as counter-balanced mills, combination elliptic roll and ball mill, and impact amalgamators. Pp. 40.

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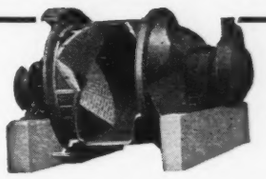

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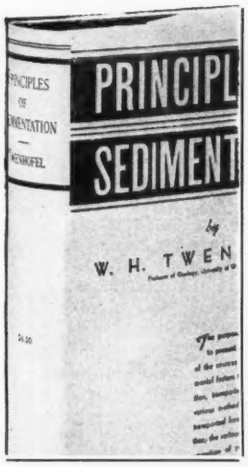

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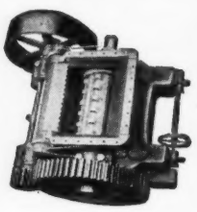

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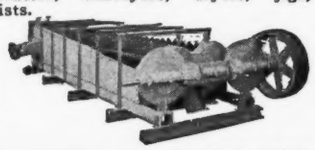

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